

CHAPTER 6 WASHOUGAL RIVER BASIN

This chapter describes the shoreline waterbodies within the Washougal River basin, part of the Salmon-Washougal watershed which is designated as Water Resource Inventory Area (WRIA) 28. The Washougal River basin includes the Washougal River as a “shoreline of statewide significance”, and 12 other shorelines of the state (see Maps 6-1 and 6-2 included at the end of this chapter for location of waterbodies and reach breaks). Of these 12 shorelines, two are natural lakes, one is a reservoir internal to a river (Lacamas Lake), and nine are rivers with mean annual flow over 20 cubic feet per second (cfs). This basin includes the Little Washougal River and other tributaries entering the Washougal River, as well as the Lacamas River and its tributaries. Waterbodies are organized with shorelines of statewide significance listed first, and then shorelines of the state listed in geographic order moving from downstream to upstream.

6.1 Washougal River

6.1.1 Physical and Biological Characterization

6.1.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

The Washougal River headwaters are in Gifford Pinchot National Forest in Skamania County. The river flows southwest through Clark County and Washougal, joining the Columbia River at Camas. Major tributaries include Lacamas Creek, Little Washougal River, Canyon Creek, North Fork Washougal River, Dugan Creek, and Cougar Creek. Lacamas Creek joins the Washougal River about 0.5 miles upstream of the confluence with the Columbia River. The Little Washougal River joins the mainstem at about river mile (RM) 5.6.

The Washougal River is approximately 33 miles long with a watershed area of 212 square miles. Twelve miles of the river and 50 square miles of the watershed are located in Clark County. The upper watershed is largely forested, and the middle reaches are rural residential and agricultural. The lower four miles of the river flows through the urban areas of Washougal and Camas. The lower part of the river experiences small daily tidal fluctuations from the Columbia River (Parametrix, 2008; Wade, 2001). The Washougal River is considered a shoreline of statewide significance downstream of its confluence with the Little Washougal River. Reaches WASH_RV_01 and 02 are considered part of a shoreline of statewide significance, and reaches WASH_RV_03 and 04 are considered shorelines of the state.

In the southeastern portion of Clark County, the Washougal River drains an estimated 50 square miles and flows westerly until the confluence with the Columbia River at RM 120 between the city of Camas and the city of Washougal. The upper Washougal River flows through a narrow, shallow valley, while the lower four miles are within the Columbia River valley. The Washougal River is a free-flowing river in the study area that runs through a moderately steep canyon from approximately RM 12 to RM 4.5 then through alluvial floodplain deposits in the lower reaches.

Approximately 205 acres of the Washougal River shoreline planning area are mapped as wetland by Clark County. Most of this is within a large wetland complex (palustrine emergent, scrub-shrub, and forested) located in the floodplain area at the river mouth and Lacamas Creek confluence. Upstream of NE 3rd Avenue (Evergreen Highway), the Washougal River floodplain is generally narrow with scattered wetlands. Processes and Channel Modifications

The Washougal River basin has been extensively modified. Some of the modifications include:

- Urban and suburban development;
- Conversion from forests to rural residential development;
- Streamside development and channelization associated with agriculture, residential/urban development, and roadways;
- Disconnected floodplains;
- Installation of dikes and riprap;
- Splash damming and logging that have left some portions of the river scoured to bedrock;
- Gravel mining and levees; and
- Culverts that have modified the natural flow regime.

Historically, the Washougal River sediment would have formed an alluvial fan and delta that reached into the floodplain of the Columbia River (R2 Resource Consultants, 2004c). As sediment would build up in the Washougal River, the river would probably have migrated across the delta. The west-trending channel path observed over the past 150 years suggests that the Columbia River has kept the Washougal River channel confined to the sideslope (R2 Resource Consultants, 2004c).

Along the lower 5.5 miles of the river, the area of currently unconstrained floodplain is 27 percent smaller than the historical floodplain (R2 Resource Consultants, 2004c). The reduction may be due to sediment deposition, channel migration, off-channel habitat development, and bank erosion. In the last 150 years, most floodplain surfaces adjacent to the lower 4.2 miles of the Washougal River have been cleared and used for residential and industrial development, or parks (R2 Resource Consultants, 2004c). The loss of approximately 31 acres of historic floodplain has occurred near RM 2. This loss of floodplain includes a levee that separates approximately 13 acres of ponds associated with gravel mining from the Washougal River.

6.1.1.2 Geologic and Flood Hazard Areas

Flood hazards along the Washougal River occur primarily along the lower reach, within the Columbia River valley, and are associated with streamflow. The riverine flooding is identified on FEMA (2007) Flood Insurance Rate Maps (FIRMs) and shown in Appendix A, Map 6. Flooding along the lower Washougal River is partially confined due to levees. The FIRMs show some streamflow flooding adjacent to the lower reach of the Washougal River. The existing floodplain in the lower reach of the Washougal River ranges from approximately 0.1 to 0.5 miles wide.

Severe erosion hazards have been identified along the Washougal River (Appendix A, Map 12). The Washougal River, upstream of the confluence with the Little Washougal River, consists of consolidated sediment in the middle reach and semi-consolidated sediment in the upper reach (Appendix A, Map 13) indicating the potential for seismic hazards would be minimal in the middle and upper reach. The Washougal River has landslide hazards associated with areas of potential instability and older landslide debris (Appendix A, Map 14).

The surface geology in the Washougal River sub-basin downstream of the confluence with the Little Washougal River is composed primarily of unconsolidated sedimentary material (LCFRB, 2004d; Appendix A, Map 13). The Washougal River is classified as having a moderate to

moderate-high potential for channel migration (Olson, 2010; Appendix A, Map 27). Severe erosion and landslide hazards primarily occur along the Washougal River in the area upstream of the city of Washougal, as shown in Appendix A, Maps 12 and 14.

6.1.1.3 Critical or Priority Habitat and Species Use

The Washougal River supports federally listed Chinook, chum, and coho salmon, and steelhead (Table 6-1). The river provides a migration corridor for both adult and juvenile fall Chinook salmon, and it is known to provide both spawning habitat for adult fall Chinook and rearing habitat for juvenile Chinook (WDFW, 2009a). Fall chum are documented as using the Washougal River for migration (WDFW, 2009a), but spawning habitat has not been documented. The Washougal River is also a documented migration corridor for coho salmon. Summer and winter steelhead spawn in portions of the river and rearing habitat is known for summer steelhead.

The Washougal River within Clark County is designated critical habitat for the Lower Columbia River (LCR) Chinook salmon Evolutionarily Significant Unit (fESU) and the LCR steelhead Distinct Population Segment (DPS) from RM 0 to 12 (the border with Skamania County) (70 FR 52630). The critical habitat designation for these two species continues upstream into Skamania County. Columbia River chum salmon critical habitat in the Washougal River extends from RM 0 to approximately RM 10, just upstream of the confluence with Cougar Creek (70 FR 52630). Critical habitat for coho salmon has not been proposed.

Priority habitats associated with the Washougal River include oak woodlands mapped along the lower reaches (WDFW, 2009a). The Washington Department of Natural Resources (WDNR) Natural Heritage Program identifies State Sensitive small-flowered trillium within the Washougal River shoreline planning area (WDNR, 2008).

Table 6-1. Listed Fish Species in the Washougal River

| Common Name and Population * | Scientific Name | Federal Status | Designated Critical Habitat in the Study Area? | Habitat Use |
|--------------------------------------|---------------------------------|----------------|--|--------------------------------|
| Chinook salmon, Lower Columbia River | <i>Oncorhynchus tshawytscha</i> | T | Yes | Migratory / rearing / spawning |
| Chum salmon, Columbia River | <i>Oncorhynchus keta</i> | T | Yes | Migratory |
| Coho salmon, Lower Columbia River | <i>Oncorhynchus kistutch</i> | T | No | Migratory |
| Steelhead, Lower Columbia River | <i>Oncorhynchus mykiss</i> | T | Yes | Migratory / rearing / spawning |

* Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS)

6.1.1.4 Instream and Riparian Habitats

Habitat survey data collected in four representative reaches of the Washougal River between RM 0.7 and 1.7 (tidal), RM 1.7 and 4.4, RM 13.3 and 13.9, and 22.6 and 24.4 are summarized below (R2 Resource Consultants, 2004c). Instream habitat in the lower Washougal River consists

primarily of small cobble riffles and glides with approximately two pools every kilometer (R2 Resource Consultants, 2004c). Pool depth ranges from 10 to 15 feet (R2 Resource Consultants, 2004). Cascades and large cobble riffles are absent from the lower reaches (RM 0.7 to 4.4). Substrate is primarily gravel and cobbles with some boulders. Fine sediments are largely absent from the Washougal River basin (R2 Resource Consultants, 2004c). Large wood is limited in the lower reaches, with approximately 3.5 pieces per kilometer. Active channel width in the mainstem ranges from 100 to 150 feet (R2 Resource Consultants, 2004c).

Instream habitat in the higher reaches consists of pools (four to six feet deep), pool tailout, small cobble riffles, and glides. Large cobble riffles and cascades are also present but not dominant. Substrate is primarily bedrock and gravel, with cobbles, boulders, and some sand. Large wood is approximately 12 pieces per kilometer. Active channel width is about 90 feet. Cover for fish in the Washougal River is mainly provided by depth; undercut banks and overhanging vegetation are lacking.

Side channels and off-channel habitat are lacking in the Washougal River; however, several secondary flow channels are present in the lower river. These channels are created in the mainstem by islands or bars (R2 Resource Consultants, 2004c). The lower reach of Lacamas Creek serves as backwater habitat for the Washougal River. Spawning-sized gravels are limited throughout the Washougal River basin, with potential suitable gravels located in areas that are unusable except during high flow when redd washout is a risk (R2 Resource Consultants, 2004c). Past gravel mining is cited as the reason for a lack of suitable spawning gravels in the mainstem (Wade, 2001).

The Washougal River has been disconnected from its floodplain at RM 2 where a levee separates 31 acres of gravel mining ponds from the mainstem. At RM 4, another levee protects a 15-acre farm field from flooding. The percentages of unmodified channel banks in the lower Washougal River are as follows: 51 percent (RM 0 to 0.7), 75 percent (RM 0.7 to 1.8) and 68 percent (RM 1.8 to 5.5). Bank modifications in the lower reaches include levees, bank armoring, and road construction (R2 Resource Consultants, 2004c).

Riparian vegetation along the Washougal River ranges from stands of trees that are exclusively hardwood in the lower reaches, to dense stands of conifers near the county line, with stands of mixed conifers and hardwoods in between. Most areas along the river have experienced some encroachment by human activity including urbanization, road construction, and timber harvesting. According to a 2004 Washougal River basin assessment, riparian vegetation provides only an average of 27 percent shading of the mainstem. State Forest Practice Rules recommend at least 40 percent shading to maintain ideal water temperatures (R2 Resource Consultants, 2004c). The lower, wide reaches of the Washougal River are not expected to have historically provided adequate shading due to frequent flooding (R2 Resource Consultants, 2004c).

6.1.1.5 Water Quality

The Washington State Department of Ecology (Ecology) lists the status of water quality for streams, rivers and lakes in one of five different categories recommended by the U.S. Environmental Protection Agency (EPA). The Water Quality Assessment represents the integrated report required for Sections 303(d) and 305(b) of the Clean Water Act. The 303(d) list reports on Category 5 waters, which are the “impaired” waters of the state.

The Washougal River within Clark County is not listed as exceeding state water quality standards and therefore is not assigned a category on the Ecology 303(d) list. However, just upstream of the county line from RM 12-13 the river is listed as impaired for pH and fecal coliform (Ecology, 2008). Clark County has rated the overall health of the Washougal River as good to excellent based on water chemistry and bacteria (Clark County, 2004). This high rating is likely because 63 percent of the Washougal River watershed is forested (Clark County, 2004a). High bacteria levels were observed in the mainstem during one summer. The river continues to be monitored through the Clark County Public Works volunteer program (Clark County, 2004a).

As part of the Salmon-Washougal and Lewis Watershed Management Plan, Ecology has identified four locations in the Washougal River basin that have low flow conditions – one in the mainstem near the confluence with Cougar Creek, one in upper Cougar Creek, one in an unnamed stream two miles upstream from Cougar Creek, and one in the West Fork Washougal River (Skamania County). To manage the multiple demands placed on the Washougal River, Ecology has proposed target flows by season that will be used to support stream closures and process applications for water right changes or transfers (HDR and EES, 2006).

6.1.2 Shoreline Use Patterns

6.1.2.1 Existing Land and Shoreline Uses

In its upper reaches, the Washougal River flows through timber lands and rural areas. In the lower reaches, the river flows through the cities of Washougal and Camas, and more intensively developed urban areas.

In the upper reaches, existing uses in the shoreline planning area are characterized by forestry, small-scale agriculture and rural residential development. As the river flows west, the proportion of forestry decreases and the proportion of rural residential increases, but development density remains relatively low. SE Washougal River Road parallels the river to the north and west. There is only one crossing outside of Washougal. There are no other shoreline modifications mapped in the upper reaches.

From roughly the Washougal city boundary to the 3rd Street bridge (and Camas city boundary), existing uses in the planning area are single-family residential development and parklands. Uses in the planning area downstream of the 3rd Street Bridge are characterized predominantly by the Washougal River Greenway, owned and maintained as open space by the City of Camas. Further downstream, commercial and industrial uses continue to exist, although there is a significant amount of undeveloped land including Beach Island.

At the confluence of the Washougal and Columbia Rivers, there are several shoreline industrial uses including the Georgia-Pacific Camas Mill. This mill encompasses 660 acres (including Lady Island in the Columbia River channel) on the shorelines of both the Columbia and Washougal Rivers. Several roadways and railroads parallel the river. However, there are few transportation facilities that cross the river. Downstream of Washougal River Road, the only crossings are the 3rd Street Bridge/ Evergreen Highway, 6th Street / SR 500, and the BNSF railroad. The 6th Street and BNSF crossings are parallel to each other immediately upstream of Beach Island. In 2008, the City of Camas completed a pedestrian trail and waterline bridge

which crosses the Washougal River. There are no other shoreline modifications mapped along the river.

6.1.2.2 Environment Designations, Zoning and Other Regulations

Shoreline planning and zoning for the Washougal River shoreline planning area are regulated by the Cities of Camas and Washougal and Clark County. The shoreline environment designation of this river is mainly Urban with some areas of Conservancy and Natural in the cities, and transitions to Conservancy upstream in the unincorporated areas. The majority of this planning area is zoned as residential, with other smaller areas of forest, industrial, commercial, and recreation designations. A summary of the generalized zoning designations along the Washougal River is shown in Table 6-2.

Table 6-2. Washougal River Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Forest | 48 | 5% |
| Commercial | 14 | 2% |
| Industrial | 155 | 17% |
| Parks & Open Space | 25 | 3% |
| Public Facilities | 0.06 | 0.01% |
| Residential – Multi-Family | 87 | 9% |
| Residential – Single-Family | 595 | 64% |
| Total | 924 | 100% |

6.1.2.3 Existing Public Access

The Washougal River shoreline planning area has several neighborhood, community, and regional parks within the cities of Camas and Washougal. There are lands owned by the Washington Department of Fish and Wildlife (WDFW) and WDNR in the upper portions of the river system. There are also developed and proposed trails that wind along a large portion of this shoreline planning area. A summary of the public access facilities for the Washougal River is found in Table 6-3.

Table 6-3. Washougal River Public Access Facilities

| Facility Name | Facility Type | Area within Shoreline | Status |
|---------------------------------------|-------------------|---------------------------|---------------------------|
| Oak Tree Park | Neighborhood Park | 2.5 acres | Developed |
| Washougal River Greenway | Greenway | 86.7 acres/ 10.7 acres | Developed/ Undeveloped |
| Washougal River Trail | Trail | 1.5 miles/ 10.5 miles | Developed/ Undeveloped |
| Hathaway Park | Community Park | 8.2 acres | Developed |
| Riverbend | Neighborhood Park | 0.5 acres | Developed |
| Sandy Swimming Hole | Community Park | 1.3 acres | Developed |
| WDFW | Natural Resource | 13.8 acres | Undeveloped |
| Washington State Parks and Recreation | Recreation | 29 acres | Undeveloped |
| DNR | Natural Resource | 11 acres | Undeveloped |

6.1.2.4 Historic and Cultural Resources

Cultural resources within the Washougal River shoreline planning area include several recorded pre-contact materials, camp sites, and villages. Native American use of the entire Clark County area, including areas around the Washougal River, is documented in detail in the Columbia River shoreline section. There are 17 total recorded materials within the Washougal River shoreline planning area, 15 of which are pre-contact sites, including villages, camp sites, lithic material scatters and isolates. The remaining two recorded sites include unregistered historic structures and sites, including a refuse scatter dump and a residential structure. The majority of recorded sites are within areas of more significant recent development, in Washougal and Camas.

Historic resources are documented through a variety of sources. Official registers include the National Register of Historic Places and the Washington State Heritage Register. The Washington Information System for Architectural and Archaeological Records Data was used to identify state and federal historic resources within the Washougal River shoreline planning area, as well as other shoreline areas in Clark County.

Registered resources include the following:

- Camas Main Post Office – National and State Registers.
- Farrell Building – National and State Registers.

6.1.2.5 Areas of Special Interest

Ecology has previously monitored two contaminated sites within the Washougal River shoreline planning area – a Hazardous Waste Generator facility within the city of Camas (sub-reach WASH_RV_02a), and receipt of a Tier 2 Emergency/Hazard Chemical Report for the WDFW Washougal Salmon Hatchery. Activities related to both sites occurred in the first half of the 1990s.

6.1.3 Opportunity Areas

6.1.3.1 Restoration and Protection

The Washougal River basin is an important system for fisheries. Several opportunities exist for protecting existing resources (e.g., headwater forests) while restoring in-stream habitat elements. A majority of the Washougal River in the study area is identified as high priority for fish habitat restoration (LCFRB, 2004d).

The lower Washougal River has been heavily impacted by development. Urbanization has affected wildlife habitat, large wood recruitment, riparian vegetation, stream temperature, hydrology, and sedimentation. Much of the lower river, from the mouth to the Little Washougal River, has been diked and riprapped. The upper reaches of the river are relatively intact but affected by sedimentation from unstable forest roads (Parametrix, 2008; Wade, 2001).

The *Washougal River Greenway Shoreline Inventory and Characterization* (Parametrix, 2008) identified numerous restoration opportunities on the river and its tributaries, such as development of off-channel rearing habitat, restoration of riparian forest, placement of large wood, breaching of levees, and spawning gravel enhancement. Restoration projects along the lower Washougal River are underway.

The City of Washougal Parks Department identified restoration opportunities at Hathaway Park. The department plans to replace the existing degraded boat launch, plant native vegetation in the riparian area, and continue to control for invasive plant species. See Volume 2, Section 6.3.3.8 for additional park plans. The department also strives to control invasives at the Sandy Swimming Hole and River Bend Park (City of Washougal, 2008). The WRIA 28 Salmon and Steelhead Limiting Factors report (Wade, 2001) identifies the upper Washougal River and its tributaries as providing some of the best salmonid habitat in WRIA 28. The report recommends protecting these headwater streams, as well as: restoring and enhancing floodplain and side channel habitat on the Washougal River mainstem; reducing sedimentation throughout the basin by fencing livestock out of streams, restoring riparian corridors, and restricting ATV use to areas where impacts can be mitigated; and supplementing large woody debris (LWD).

The Lower Columbia Fish Recovery Board has identified key restoration priorities for salmon recovery in the Washougal River. The Board's Six-Year Habitat Work Schedule (LCFRB, 2009b) groups these priorities into categories, such as: protecting stream corridor structure and function; protecting and restoring hillslope processes; providing for adequate in-stream flows; restoring riparian conditions; restoring floodplains and channel migration processes; restoring water quality; and restoring access to habitats blocked by artificial barriers. For each of these categories, the report makes specific recommendations for types and in some cases locations of restoration projects.

Other restoration measures and management recommendations include:

- Restore floodplain connectivity where feasible along the lower mainstem and in major tributaries where bank armoring has occurred. Related restoration includes creating off-channel habitat in the lower mainstem for salmon rearing and/or spawning habitat;

- Prevent floodplain impacts from new development through land use controls and best management practices;
- Install large wood in the mainstem to enhance channel conditions;
- Protect and restore native plant communities from the adverse effects of invasive species (HDR-EES, 2006); and
- Continue to control and remove knotweed, an invasive plant that spreads by rhizomes. One and a half miles of the Washougal River were treated in 2007 (Clark County, 2007c).

6.1.3.2 Public Access

Most of this planning area has access to the Washougal River shorelines within the urban areas, either through parks or via the proposed trails. A detailed description of these existing and planned facilities can be found in the *City of Camas Parks and Open Space Plan* (2007) and *Washougal Comprehensive Park and Recreation Plan* (2006). However, due to the large amount of residential development in this area, other opportunities could include local parks and green spaces at road ends and within riparian buffers, or extension of existing trails.

6.1.4 Reach Scale Assessment

The Washougal River has been divided into four reaches. Table 6-4 provides a brief description of each reach and highlights key modifications, unique features and restoration opportunities.

Table 6-4. Reach Assessment for Washougal River

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|---|---|---|--|---|
| WASH_RV_01 | Mouth of Washougal River, from Lacamas confluence to Columbia River | 0.7 | Vegetated, 1500 ft. wide river bed with adjacent residential district. 660 acre Georgia-Pacific Camas Mill. | Levees on 50% or more of shoreline. Multiple bridge crossings, including: 2 highways, one railroad bridge; a pedestrian crossing, and a waterline. | Approximately 49 acres of wetland. Tidal section. | Low quality. Mostly vegetated with shrubs and few trees. | Install LWD to enhance fish habitat. Restore floodplain connectivity. Restore off-channel habitats for salmonids. Enhance riparian zone with trees where feasible. |
| WASH_RV_02 | Upstream of mouth of Washougal to the confluence with the Little Washougal River | 4.7 | Suburban and residential uses. Large tracts of park with varied vegetation. | Levees. Two road crossings with bridges 1 mapped dock/pier. Active mine site. | . Lower 1.2 miles are the Washougal River Greenway, Has natural pools. Approximately 93 acres of wetland. | Varies from low to moderate quality. Some areas well vegetated, other areas residential. | Install LWD to enhance fish habitat. Restore floodplain connectivity. Protect forested riparian zones. Enhance riparian areas with tree planting. |
| WASH_RV_03 | Confluence with the Little Washougal River to the confluence with Cougar Creek. | 2.8 | Rural, limited agriculture. Forested. Conversion of forests to agricultural land. | NE Washougal River Road parallels north river bank, armoring. Road confines channel migration. | Approximately 29 acres of wetland. | High quality. Well vegetated with trees and shrubs. High degree of natural connectivity. | Protect forested riparian areas. Soften bank armoring Restore riparian areas on north bank. |
| WASH_RV_04 | Upstream of Cougar Creek. | 3.9 | Rural. Light residential development. Forested. | Conversion of forests to agricultural land. NE Washougal River Road parallels river Residential development on north bank with armoring. | Large tracts of land owned by DNR. Approximately 34 acres of wetland. | High quality. Well vegetated with trees and shrubs. High degree of natural connectivity. | Protect water quality. Reconnect river to channel migration zone Restore riparian areas. |

6.2 Little Washougal River

6.2.1 Physical and Biological Characterization

6.2.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

The Little Washougal River basin covers 24.5 square miles. Its headwaters originate from forested foothills of the Cascade Range (Clark County, 2007c). The Little Washougal River flows 10 miles over moderately steep terrain and enters the mainstem Washougal River at RM 5.6. Major tributaries of the Little Washougal River include the East Fork Little Washougal River (which drains a portion of Skamania County) and Boulder Creek. Several small headwater streams feed the Little Washougal River. Existing uses in the upper basin consist of timber production and recreation, while uses in the lower portions consist of residential and agricultural uses.

Approximately 83 acres of the Little Washougal River shoreline planning area is mapped as floodplain wetlands by Clark County.

6.2.1.2 Processes and Channel Modifications

Primary process and channel modifications in the Little Washougal River basin include:

- Conversion of forested land to rural residential development and agricultural activity in the lower reaches; and
- Agricultural diversion in the lower reaches.

More than 40 percent of the land cover within the Little Washougal River basin is classified as non-forest land (HDR and EES, 2006). Non-forest land includes urban, agriculture, pastures, and cleared areas.

6.2.1.3 Geologic and Flood Hazard Areas

Flood hazards occur along the Little Washougal River and are primarily associated with streamflow. Flooding is identified in FEMA FIRMs and shown in Appendix A, Map 6 (FEMA, 2007). The Little Washougal River is classified as having a moderate to high potential for channel migration (Olson, 2010; Appendix A, Map 27). Severe erosion hazards have been identified along the Little Washougal River, especially near the confluence with Boulder Creek (Appendix A, Map 12). The lower reach of the Little Washougal River consists of unconsolidated sediment and is subject to seismic hazards. The upper reach of the Little Washougal River consists of consolidated sediment and has minimal seismic hazards (Appendix A, Map 13). The Little Washougal River has landslide hazards associated with the entire reach. The lower reach includes areas of older landslide debris and areas of potential instability. The upper reach includes areas of slopes greater than 15 percent.

6.2.1.4 Critical or Priority Habitat and Species Use

The Little Washougal River supports federally listed Chinook, chum, and coho salmon, and steelhead (WDFW, 2009a; WDFW, 2009b). Spawning habitat for winter steelhead and coho

salmon has been verified in the stream (WDFW, 2009a). Resident cutthroat are also mapped as occurring in the Little Washougal River.

Critical habitat for chum salmon and Chinook salmon is mapped from RM 0 to approximately RM 2 (70 FR 52630). The majority of the Little Washougal River basin, including the mainstem, is mapped as critical habitat for steelhead (70 FR 52630). No other priority habitats or species are mapped for the Little Washougal River (WDFW, 2009a).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the Little Washougal River shoreline planning area (WDNR, 2008).

6.2.1.5 Instream and Riparian Habitats

Instream habitat in the Little Washougal River consists primarily of small cobble riffles, pools and pool tailouts with some areas of large cobble riffles. Glides and cascades are uncommon. The active channel width is approximately 45 feet. Pool frequency ranges from 8.6 to 12.7 pools per kilometer (R2 Resource Consultants, 2004c).

Gravel, cobble, and boulders are the dominant substrate with areas of sand and bedrock (R2 Resource Consultants, 2004). Large wood is more common in the Little Washougal River than in the Washougal River, and ranges from 7.9 to 22.9 pieces per kilometer (R2 Resource Consultants, 2004c). Cover for fish is mainly provided by depth, with some cover provided by overhanging vegetation and large wood.

Riparian habitat in the lower Little Washougal River is considered poorly functioning due to urban development, road construction, and a sparse deciduous canopy (R2 Resource Consultants, 2004c). The remaining watershed is rated good to fair for riparian habitat condition. Hardwood is the dominant riparian habitat in the lowest reach (RM 0 to 2.8) while mixed stands and conifers dominate the riparian habitat in the middle and upper reaches.

Water withdrawals for the City of Camas' municipal drinking water supply are indicated as one of the causes of low flow conditions in the Little Washougal River (Wade, 2001).

Several portions of the lower Little Washougal River have been diked and armored to protect residential development, resulting in channelization and a loss of floodplain habitat (Wade, 2001).

6.2.1.6 Water Quality

The mainstem of the Little Washougal River is rated "poor" and "fair" for stream health due to occasional high temperatures and fecal coliform levels in the summer (Clark County, 2003; Clark County, 2004a). A poor rating is defined as "inferior health, poorly suited for aquatic life and recreation" and a fair rating is defined as "degraded, but may support aquatic life and recreation." The sources of fecal coliform are likely failing septic tanks and/or a dairy farm located along the lower river. In contrast, the headwaters of the Little Washougal River basin, which includes Jones Creek, are rated as excellent (Clark County, 2004a). An excellent rating is reserved for waters that are "pristine, superior, or in unsurpassed condition" with "minimal disturbance" (Clark County, 2003). No segments of the Little Washougal River are recorded on Ecology's 303(d) list of impaired waters (Ecology, 2008).

6.2.2 Shoreline Use Patterns

6.2.2.1 Existing Land and Shoreline Uses

The Little Washougal River flows south approximately eight miles within the east end of unincorporated Clark County to its confluence with the Washougal River north of the city of Washougal. The river flows through timber lands in its upper reaches and rural areas in the lower reaches. The general use pattern within the river's shoreline planning area is characterized by forest, rural residential development, and agricultural uses.

Several roadways that parallel and cross the Little Washougal River include SE Washougal River Road, SE Blair Road (twice), SE 6th Street, and NE Timothy Road. There are also several private drive crossings within the shoreline planning area. A BPA transmission line also crosses the river. There are no water-oriented uses within the shoreline planning area.

Other than bridge crossings and culverts, there are no levees or other significant shoreline modifications mapped within the Little Washougal River.

6.2.2.2 Shoreline Environment Designations and Zoning

The Little Washougal River lies entirely within the unincorporated areas of Clark County. The upstream reaches of this shoreline planning area have the environment designations of Rural and Conservancy, and are zoned for forest and rural residential uses. Further downstream, near the confluence with the Washougal River, the shoreline environment designation is all Conservancy with rural residential zoning. A summary of the zoning designations along the Little Washougal River is shown in Table 6-5.

Table 6-5. Little Washougal River Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|------------|-------------|
| Forest | 202 | 39% |
| Residential – Single-Family | 317 | 61% |
| Total | 519 | 100% |

6.2.2.3 Existing Public Access

There are currently no public access opportunities within the Little Washougal River shoreline planning area. A 0.21-mile section of the planned East Powerline Trail would cross the river at its approximate mid-point.

6.2.2.4 Historical and Cultural Resources

Cultural resources within the Little Washougal River shoreline planning area include two recorded sites. Both sites include historic components (historic homestead and historic object materials) as well as pre-contact lithic material and pre-contact camp materials. Due to the location of the river and the documented use of the Clark County area by Chinookan-speaking

peoples, there is significant probability of unknown archaeological resources occurring within the shoreline planning area. Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no county-, state-, or federally-listed historic properties within the Little Washougal River shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.2.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base there are no listed facilities or contaminated sites within the Little Washougal River shoreline planning area.

6.2.3 Opportunity Areas

6.2.3.1 Restoration and Protection

The *Washougal River Greenway Shoreline Inventory and Characterization* (Parametrix, 2008) identified restoration opportunities on the river, including placement of wood in the channel, restoration of riparian vegetation, and enhancement of spawning gravels.

Other restoration opportunities identified in the WRIA 28 Salmon and Steelhead Limiting Factors report (Wade, 2001) include protecting salmonid habitat in headwater reaches; restoring and enhancing floodplain and side-channel habitat; replanting riparian vegetation; and protecting and enhancing wetland habitat. In particular, the WRIA 28 report recommends riparian restoration along the lower Little Washougal River as a high priority.

Restoration opportunities include:

- Balance the needs of instream flow with municipal drinking water;
- Remedy passage barriers along several small tributary streams such as Jackson Creek; Cotter Creek, and Larson Creek to open up rearing habitat for salmon;
- Reconnect the lower Little Washougal River with its floodplain where feasible;
- Enhance channel habitat with large wood (Wade, 2001); and
- Continue to control and remove knotweed, an invasive weed that spreads by rhizomes. Five miles of the Little Washougal River were treated in 2007 (Clark County, 2007c).

Management objectives for the Little Washougal River (Clark County, 2003) include the following:

- Protect current health;
- Maintain existing forest lands for timber production;
- Reforest fallow farm land;
- Restore native riparian forests in some areas; and
- Use BMPs in residential construction to minimize runoff.

6.2.3.2 Public Access

The planned trail segment will provide an opportunity for public access to the Little Washougal River shoreline planning area.

6.2.4 Reach Scale Assessment

The Little Washougal River has been evaluated as one reach. Table 6-6 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-6. Reach Assessment for Little Washougal River

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|--|--|------------------------------------|---|---|
| LWAS_RV_01 | From confluence with Little Washougal River East Fork to the confluence with the Washougal River. | 8.0 | Rural and agricultural uses. Natural areas. Some residential developments. | Agricultural diversions. Dikes. Shoreline armoring present. 5 road crossings BPA transmission line crossing. | Approximately 83 acres of wetland. | Degraded buffers due to residential development, agricultural uses and timber harvest | Restore riparian areas with tree plantings. Remove diversions and ditches. Protect floodplain from development. |

6.3 East Fork Little Washougal River

6.3.1 Physical and Biological Characterization

6.3.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

The East Fork Little Washougal River flows westerly in the upper watershed of the Little Washougal River for about three miles, joining the mainstem at approximately RM 6, the same point where Boulder Creek enters the mainstem. The major tributary of the East Fork Little Washougal River is Jones Creek, which originates in the forested foothills of the Cascade Range, similar to the mainstem. Jones Creek also runs for about three miles and is fed by a few unnamed streams.

The East Fork Little Washougal River joins with Cougar Creek to form the Little Washougal River. This confluence is located approximately five miles north of Washougal. The East Fork is surrounded by forest land, some of which has been recently harvested.

Approximately one acre of the East Fork shoreline planning area is mapped as wetland by Clark County. This palustrine forested wetland area is mapped at the confluence with Cougar Creek.

6.3.1.2 Processes and Channel Modifications

The East Fork Little Washougal River is located within a forested area where there have been minimal process and channel modifications.

6.3.1.3 Geologic and Flood Hazard Areas

Flood hazards along the East Fork Little Washougal River are primarily associated with streamflow. The flood hazard identified on FEMA FIRMs is minimal (Appendix A, Map 6). East Fork Little Washougal River is classified as having a moderate potential for channel migration (Olson, 2010; Appendix A, Map 27). Severe erosion hazards have been identified in the East Fork Little Washougal River watershed (Appendix A, Map 12). The East Fork Little Washougal River consists of consolidated sediment and minimal seismic hazards (Appendix A, Map 13). Landslide hazards do exist along the river (Appendix A, Map 14).

6.3.1.4 Critical or Priority Habitat and Species Use

The East Fork Little Washougal River supports federally listed coho salmon and steelhead (WDFW, 2009a). Both summer and winter runs of steelhead occur in Jones Creek and the mainstem. Critical habitat for steelhead is mapped for the East Fork Little Washougal River basin (70 FR 52630). No other priority habitats or species are mapped (WDFW, 2009a).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the East Fork Little Washougal River shoreline planning area (WDNR, 2008).

6.3.1.5 Instream and Riparian Habitats

Little information on instream and riparian habitat characteristics is available for the East Fork Little Washougal River.

The lower segments of the East Fork Little Washougal River and Jones Creek are rated “low” for large wood recruitment potential, while the upper segments are rated “moderate” (R2 Resource Consultants, 2004c). The entire Washougal River basin within Clark County, including the East Fork, is considered “off-target” for state stream shading standards (R2 Resource Consultants, 2004c). “Off-target” means that the amount of shade over the stream does not comply with state stream shading standards for the protection of stream temperatures (Washington Forest Practices Board WFPB, 1997).

6.3.1.6 Water Quality

The East Fork Little Washougal River is rated as “excellent” for stream health based on water chemistry and bacteria (Clark County, 2003). An excellent rating is defined as “pristine, superior, or unsurpassed condition; minimal human disturbance” (Clark County, 2003). No segments of the East Fork Little Washougal River are recorded on Ecology’s 303(d) list of impaired waters (Ecology, 2008).

6.3.2 Shoreline Use Patterns

6.3.2.1 Existing Land and Shoreline Uses

The East Fork Little Washougal River flows west through cleared timber land. Existing uses in the shoreline planning area are characterized by forestry. There are no paved roads within the shoreline planning area, although there is a network of unpaved logging roads, some of which are located within the shoreline planning area and one of which crosses the river.

6.3.2.2 Shoreline Environment Designations and Zoning

The East Fork Little Washougal River lies in unincorporated Clark County. This planning area has a shoreline environment designation of Conservancy. This designation is intended for sparse development and includes passive agriculture and recreational uses and sustainable timber harvest. The East Fork Little Washougal River planning area is bordered entirely by 43.28 acres of property zoned as forest.

6.3.2.3 Existing Public Access

There is currently no public access within the East Fork Little Washougal River shoreline planning area.

6.3.2.4 Historical and Cultural Resources

There are no recorded archeological or unregistered historic sites within the East Fork Little Washougal River shoreline planning area (DAHP, 2010; Clark County, 2010d). There are also no county-, state-, or federally-listed historic properties within this shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.3.2.5 Areas of Special Interest

There are no Ecology-listed facilities or contaminated sites within the East Fork Little Washougal River shoreline planning area.

6.3.3 Opportunity Areas

6.3.3.1 Restoration and Protection

Restoration opportunities for the East Fork Little Washougal River include decommissioning or repairing logging roads to prevent sedimentation, replanting riparian areas with native trees, and removing failing culverts.

The East Fork Little Washougal River from RM 0 to the confluence with Jones Creek is considered a high priority reach for coho salmon and steelhead habitat restoration (LCFRB, 2004d). The remaining stream segments of the East Fork Little Washougal River and most of Jones Creek are considered low priority fish habitat restoration areas (LCFRB, 2004d).

6.3.3.2 Public Access

This area is undeveloped and used for forest management. Further investigation may be needed to determine if public access would be appropriate.

6.3.4 Reach Scale Assessment

The East Fork Little Washougal River has been evaluated as one reach. Table 6-7 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-7. Reach Assessment for East Fork Little Washougal River

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|------------------------|--|-----------------|--|---|
| EFLW_RV_01 | From 20 cfs point to confluence with Little Washougal River. | 0.9 | Forest resource lands. | Timber harvest. Unpaved logging roads. | None. | Moderate quality. Entire bank and floodplain vegetated with dense trees and shrubs. Low shade cover. | Replant riparian areas and remove failing culverts. |

6.4 Boulder Creek

6.4.1 Physical and Biological Characterization

6.4.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Boulder Creek originates near the base of Larch Mountain and flows south for 3.5 miles through forested terrain. Boulder Creek enters the Little Washougal River at RM 6 and appears to be an extension of the mainstem. The Boulder Creek watershed includes several small, unnamed streams that flow southeast into the mainstem from a ridgeline that includes Spud and Livingston Mountains (USGS, 1993b).

Approximately 49 acres of the Boulder Creek shoreline planning area is mapped as wetland by Clark County. The NWI maps these as palustrine forested wetlands. Aerial photos show a large wetland area containing forested, scrub-shrub, and emergent habitat types located along the east side of lower Boulder Creek.

6.4.1.2 Processes and Channel Modifications

The Boulder Creek watershed is located within a forested area where there have been minimal process and channel modifications.

6.4.1.3 Geologic and Flood Hazard Areas

Flood hazards along Boulder Creek are associated with streamflow. The flood hazard identified on FEMA FIRMs is less extensive than along the larger waterbodies such as the Washougal River (Appendix A, Map 6). Boulder Creek is classified as having a moderate to high potential for channel migration (Olson, 2010; Appendix A, Map 27). Severe erosion hazards have been identified to the west of Boulder Creek (Appendix A, Map 12). Boulder Creek consists of consolidated sediment with minimal seismic hazards (Appendix A, Map 13). Landslide hazards exist primarily on the west side of Boulder Creek, where slopes are greater than 15 percent (Appendix A, Map 14).

6.4.1.4 Critical or Priority Habitat and Species Use

Federally listed coho salmon and steelhead (summer and winter runs) are mapped as using Boulder Creek (WDFW, 2009a). No passage barriers are recorded for this stream (Wade, 2001). Spawning and rearing habitat is known for winter steelhead in Boulder Creek, but has not been verified for summer steelhead or coho salmon (WDFW, 2009a). Rainbow trout and resident cutthroat are also mapped for Boulder Creek.

Boulder Creek and its unnamed tributaries are mapped as designated critical habitat for steelhead (70 FR 52630). Other than fish, no priority habitats or species are known to occur along Boulder Creek (WDFW, 2009a).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the Boulder Creek shoreline planning area (WDNR, 2008).

6.4.1.5 Instream and Riparian Habitats

Instream habitat in Boulder Creek is primarily small cobble riffles with approximately 19 pools per kilometer (R2 Resource Consultants, 2009). Boulder Creek has one of the highest pool frequencies of the reaches studied in the 2004 Washougal River Habitat Assessment, but the majority of the pools are less than three feet deep (R2 Resource Consultants, 2004). The active channel width of Boulder Creek in the assessed reach (RM 0 to 1.6) is approximately 27 feet. Channel substrate consists of cobble, boulder, and gravel with some sand and very little bedrock (R2 Resource Consultants, 2004c).

Boulder Creek also has the highest large wood count per kilometer (96.0 pieces/km) of all the assessed reaches in the Washougal River basin, yet it is rated low for large wood recruitment potential due to sparse tree density and small tree size in the riparian zone (R2 Resource Consultants, 2004c). Cover for fish in this headwater stream is provided by a combination of large wood, undercut banks, overhanging vegetation, and water depth. Overall canopy cover of the riparian habitat along Boulder Creek is considered to be below state stream shading standards (40 percent cover minimum) (R2 Resource Consultants, 2004c).

The City of Camas withdraws water from Boulder Creek (as well as Jones Creek, a tributary of the East Fork Little Washougal River) for municipal drinking water. Low flow conditions have been identified as a limiting factor for fish habitat in this stream as well as downstream in the Little Washougal River (Wade, 2001). The City of Camas has relocated its well to the lower Washougal River to an area that has minimal impact on streamflow (Giglio et al., 1996).

6.4.1.6 Water Quality

Boulder Creek is rated “good” for stream health based on water chemistry and bacteria (Clark County, 2003). A good rating is defined as “healthy enough to support aquatic life and recreation” (Clark County, 2003). No segments of Boulder Creek are recorded on Ecology’s 303(d) list of impaired waters (Ecology, 2008).

6.4.2 Shoreline Use Patterns

6.4.2.1 Existing Land and Shoreline Uses

Described under Section 6.2.2 – Little Washougal River.

6.4.2.2 Shoreline Environment Designations and Zoning

Described under Section 6.2.2 - Little Washougal River.

6.4.2.3 Existing Public Access

Described under Section 6.2.2 - Little Washougal River.

6.4.2.4 Historical and Cultural Resources

There are no recorded archeological or unregistered historic sites within the Boulder Creek shoreline planning area (DAHP, 2010; Clark County, 2010d). There are no county-, state-, or

federally-listed historic properties within the shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.4.2.5 Areas of Special Interest

There are no Ecology-listed facilities or contaminated sites within the Boulder Creek shoreline planning area (Ecology, 2010).

6.4.3 Opportunity Areas

6.4.3.1 Restoration and Protection

Fish habitat restoration in Boulder Creek is considered a relatively low priority compared with other sub-watersheds in the Washougal River basin (LCFRB, 2004d). Addressing low flow conditions due to water withdrawals is a possible restoration opportunity for this stream.

The *Washougal River Greenway Shoreline Inventory and Characterization* (Parametrix, 2008) identified restoration opportunities on Boulder Creek, including placement of wood in the channel, enhancement of spawning gravels, and use of BMPs during timber harvest and development to reduce sedimentation.

6.4.3.2 Public Access

This area is undeveloped and used for forest management. Further investigation may be needed to determine if public access would be appropriate.

6.4.4 Reach Scale Assessment

Table 6-8 provides a brief description of the Boulder Creek reach and highlights key modifications, unique features and restoration opportunities.

Table 6-8. Reach Assessment for Boulder Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|------------------------|---|------------------------------------|--|---|
| BOUL_CK_01 | From 20cfs point to confluence with the Little Washougal River. | 1.6 | Forest resource lands. | Boulder Creek Road parallels shoreline. | Approximately 49 acres of wetland. | Degraded due to timber harvest. Low shade cover. | Restore riparian areas. Decommission forest roads. |

6.5 Cougar Creek

6.5.1 Physical and Biological Characterization

6.5.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Cougar Creek is the second largest tributary of the Washougal River within the study area, draining steep, forested terrain in the foothills of the Cascade Mountains. It flows southwest for almost 4.5 miles and enters the Washougal River at about RM 9.0. The mainstem is fed by a few, small unnamed streams. The Cougar Creek basin is largely forested, with 80 percent in private and public holdings (Clark County, 2003). Most of the privately owned land, which constitutes nearly 50 percent of the basin, is slated for commercial forestry (LCFRB, 2004d). A waterfall located about 600 feet upstream of the confluence with the Washougal River reportedly blocks passage for anadromous fish (Clark County, 2003); however, steelhead are recorded as using the lower 2.3 miles of Cougar Creek (Wade, 2001).

Approximately six acres are mapped as wetland in the upper portion of the Cougar Creek shoreline planning area (less than one percent of the planning area). The NWI identifies this as palustrine forested wetland.

6.5.1.2 Processes and Channel Modifications

Primary process and channel modifications in the Cougar Creek watershed include conversion of forested land to agricultural land and rural residential. While primarily forested, a few areas of the watershed have been developed for agricultural and rural uses, especially close to the confluence with the Washougal River. The modifications to Cougar Creek have been minimal. No culverts or other instream modifications have been identified by the WDFW on this stream.

6.5.1.3 Geologic and Flood Hazard Areas

Flood hazards along Cougar Creek have not been identified on the FEMA FIRMs. Regardless, some flooding may occur during high flow events. Severe erosion hazards have been identified in the Cougar Creek basin (Appendix A, Map 12). The Cougar Creek basin has minimal seismic hazard because it primarily consists of consolidated sediment and a small amount of semi-consolidated sediment (Appendix A, Map 13). The basin has landslide hazards due to areas of potential instability and slopes greater than 15 percent (Appendix A, Map 14).

6.5.1.4 Critical or Priority Habitat and Species Use

Federally listed fish species mapped as occurring in lower Cougar Creek include fall Chinook salmon, coho salmon, and steelhead. Spawning habitat for summer steelhead is documented in Cougar Creek, whereas general migration habitat is mapped for fall Chinook, coho salmon, and winter steelhead (WDFW, 2009a; WDFW, 2009b). Resident cutthroat trout are also mapped for lower Cougar Creek (WDFW, 2009b).

The lowest reach of Cougar Creek (below the waterfall) is designated critical habitat for Chinook salmon (70 FR 52630). Almost the entire length of Cougar Creek, about four miles, is mapped as critical habitat for steelhead (70 FR 52630). Other than fish, no priority habitats or species are mapped for Cougar Creek (WDFW, 2009a).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the Cougar Creek shoreline planning area (WDNR, 2008).

6.5.1.5 Instream and Riparian Habitats

According to a watershed screening tool or Integrated Watershed Assessment (IWA), hydrologic conditions in Cougar Creek are considered “impaired” because of relatively low cover of mature trees (39 percent), and moderately high road densities (3.3 miles per square mile) (LCFRB, 2004d). Riparian habitat is dominated by conifer trees.

Overall canopy cover of the riparian habitat along Cougar Creek is below state stream shading standards (40 percent cover minimum) (R2 Resource Consultants, 2004c). Large wood recruitment potential along Cougar Creek is rated low due to relatively sparse tree density and small tree size (R2 Resource Consultants, 2004c).

6.5.1.6 Water Quality

No water quality data are available for Cougar Creek at the county or state level; however, the relatively undeveloped surroundings indicate that the water quality in this stream is good, possibly excellent (Clark County, 2003). A good rating is defined as “healthy enough to support aquatic life and recreation” and an excellent rating is defined as “pristine, superior, or unsurpassed condition; minimal human disturbance” (Clark County, 2003).

6.5.2 Shoreline Use Patterns

6.5.2.1 Existing Land and Shoreline Uses

Approximately 1.6 miles of Cougar Creek is within the Clark County shoreline planning area. The stream flows into the Washougal River on the eastern side of the county. The Cougar Creek shoreline planning area is undeveloped; there are no structures within the planning area. The stream passes through privately owned timber land from a utility corridor downstream to its confluence with the Washougal River. The shoreline planning area surrounding the stream is undeveloped, although it has been logged. Unpaved dirt roads cross into the shoreline planning area. There are no paved roads. No shoreline modifications are mapped along Cougar Creek.

6.5.2.2 Shoreline Environment Designations and Zoning

Cougar Creek, which lies entirely within the jurisdiction of Clark County, is surrounded by mostly rural property zoned as forest, with some single-family residential. A summary of the zoning designations along Cougar Creek is shown in Table 6-9. This stream was not included in the existing Clark County SMP, and does not have a current shoreline environment designation.

Table 6-9. Cougar Creek Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Forest | 59 | 90% |
| Residential – Single-Family | 7 | 10% |
| Total | 66 | 100% |

6.5.2.3 Existing Public Access

There are currently no public access opportunities along Cougar Creek. An approximately 460-foot section of the planned East Powerline Trail would cross Cougar Creek at the northernmost extent of the shoreline planning area.

6.5.2.4 Historical and Cultural Resources

There are no recorded archeological or unregistered historic sites within the Cougar Creek shoreline planning area (DAHP, 2010; Clark County, 2010d). However, due to the location of the stream and the documented use of the Clark County area by Chinookan-speaking peoples, there is some probability of unknown archaeological resources occurring within the stream's shoreline planning area. Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no county-, state-, or federally-listed historic properties within the Cougar Creek shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.5.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base, there are no listed facilities or contaminated sites within the Cougar Creek shoreline planning area.

6.5.3 Opportunity Areas

6.5.3.1 Restoration and Protection

The Cougar Creek basin is ranked as one of the lowest priority sub-basins (Group D) for fish habitat restoration, meaning that restoration in other parts of the Washougal River basin is expected to yield greater benefits (LCFRB, 2004d).

Management recommendations for this stream include (Clark County, 2003):

- Retain current forest cover; and
- Use good forest management practices.

Restoration opportunities for Cougar Creek include decommissioning or repairing logging roads to prevent sedimentation, replanting riparian areas with native trees, and removing failing culverts.

6.5.3.2 Public Access

This small planning area is mostly undeveloped. The proposed trail development will provide an opportunity for public access.

6.5.4 Reach Scale Assessment

Table 6-10 provides a brief description of Cougar Creek as one reach and highlights key modifications, unique features and restoration opportunities.

Table 6-10. Reach Assessment for Cougar Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|---------------------|---|-----------------------------|---|---|------------------------|--|--|
| COUG_CR_01 | From 20 cfs point to confluence with the Washougal River. | 1.4 | Natural areas. Forested. Minimal development. | Conversion of forest to agricultural and rural residential lands. | Steep slopes. | Moderate quality. Entire bank and floodplain vegetated with dense trees and shrubs. Low shade cover. | Restore riparian areas. Decommission forest roads. |

6.6 Hagen Creek

6.6.1 Physical and Biological Characterization

6.6.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Hagen Creek is a tributary of the West Fork Washougal River, with 2.5 miles of its length occurring in Clark County. Hagen Creek originates near the base of Larch Mountain and flows southeast for about 3.25 miles before joining the West Fork Washougal River just east of the county line. A number of multi-branched, unnamed streams flow down steep, forested hills into the stream.

The Hagen Creek watershed in Clark County consists of forest land. No wetlands are mapped within the Hagen Creek shoreline planning area.

6.6.1.2 Processes and Channel Modifications

The Hagen Creek basin within Clark County is located within a forested area where there have been minimal process and channel modifications.

6.6.1.3 Geologic and Flood Hazard Areas

Flood hazards along Hagen Creek have not been identified on FEMA FIRMs (FEMA, 2007). Severe erosion hazards have been identified along Hagen Creek (Appendix A, Map 12). The Hagen Creek basin consists of consolidated sediments and has minimal seismic hazards (Appendix A, Map 13). Slopes greater than 15 percent are present throughout the Hagen Creek basin and are associated with a potential for landslides (Appendix A, Map 14).

6.6.1.4 Critical or Priority Habitat and Species Use

Federally listed coho salmon and steelhead are mapped as occurring in Hagen Creek (WDFW, 2009a). Critical habitat for steelhead is mapped for the lower portion of Hagen Creek, but the mapping does not include the stream within the study area (70 FR 52630). No other priority habitats or species are mapped for Hagen Creek (WDFW, 2009a).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the Hagen Creek shoreline planning area (WDNR, 2008).

6.6.1.5 Instream and Riparian Habitats

Hydrologic conditions in Hagen Creek are considered intact, probably because its headwaters are on publicly owned, mature forest land and road density is relatively low (less than 3 miles per square mile) (LCFRB, 2004d). Large wood recruitment potential is rated high for Hagen Creek due to the abundance of mature trees in the watershed (R2 Resource Consultants, 2004c).

6.6.1.6 Water Quality

Hagen Creek within the study area is rated as “excellent” for stream health based on water chemistry and bacteria (Clark County, 2003). An excellent rating is defined as “pristine,

superior, or unsurpassed condition; minimal human disturbance” (Clark County, 2003). No segments of Hagen Creek are recorded on Ecology’s 303(d) list of impaired waters (Ecology, 2008).

6.6.2 Shoreline Use Patterns

6.6.2.1 Existing Land and Shoreline Uses

Hagen Creek is located along the eastern boundary of the county and flows southeast across the county line. The stream is in timber land. Existing uses within its shoreline planning area are forestry. There are no transportation facilities within the shoreline planning area.

6.6.2.2 Shoreline Environment Designations and Zoning

A portion of Hagen Creek lies in Clark County, while the remainder is in Skamania County. The Clark County portion of this stream is bordered by 53.44 acres, all within a shoreline environment designation of Conservancy. The Conservancy designation characterizes the historical use of this area for timber harvest. This planning area is zoned as forest.

6.6.2.3 Existing Public Access

The area surrounding Hagen Creek is owned by the WDNR. Although this is public land, there is no formal or informal public access to Hagen Creek.

6.6.2.4 Historical and Cultural Resources

There are no recorded archeological or unregistered historic sites within the Hagen Creek shoreline planning area (DAHP, 2010; Clark County, 2010D). Clark County archaeological resource probability mapping, however, suggests there is a significant chance of finding unknown artifacts within almost all of the County’s shoreline planning areas (Clark County, 2003). This is consistent with well documented use of Clark County’s shoreline areas by native people.

There are no historic properties within the stream’s shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.6.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base there are no listed facilities or contaminated sites within the Hagen Creek shoreline planning area.

6.6.3 Opportunity Areas

6.6.3.1 Restoration and Protection

Restoration opportunities for Hagen Creek include decommissioning or repairing logging roads to prevent sedimentation, replanting riparian areas with native trees, and removing failing culverts. Hagen Creek is within a sub-basin of the West Fork Washougal River that is ranked

one of the highest in terms of the value of fish habitat restoration; however, no reaches have been identified as requiring restoration (LCFRB, 2004d).

6.6.3.2 Public Access

This area is used for forest management. Further investigation may be needed to determine if public access would be appropriate.

6.6.4 Reach Scale Assessment

Table 6-11 provides a brief description of Hagen Creek as one reach and highlights key modifications, unique features and restoration opportunities.

Table 6-11. Reach Assessment for Hagen Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|---------------------------------|----------------|--|---|---|
| HAGE_CR_01 | From 20 cfs point to east edge of Clark County. | 1.1 | Natural areas and timber lands. | None apparent. | Entire reach resides in land owned by the DNR. | High quality. Entire bank and floodplain vegetated with dense trees and shrubs. | Decommission forest roads. Protect water quality. Protect intake forest riparian zones. |

6.7 Lacamas Creek

6.7.1 Physical and Biological Characterization

6.7.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

The Lacamas Creek drainage basin is situated entirely in Clark County and is located east of Vancouver and north of Camas. The basin encompasses 67 square miles of forest, farm, residential, commercial and industrial land. Five major tributaries feed Lacamas Creek, including the North Fork Lacamas Creek, China Ditch, Matney Creek, Fifth Plain Creek and Shanghai Creek. Forested foothills of the Cascade Mountains are located in the northeast portion of the watershed; however, the majority of the basin has been cleared for residential and agricultural purposes (Giglio and Erickson, 1996). Lacamas Creek flows 12.5 miles into Lacamas and Round Lakes. Below the lakes, Lacamas Creek flows for just under one mile through a series of waterfalls before entering the Washougal River (Clark County, 2004c).

Lacamas Creek has its headwaters in forested areas and wetlands northeast of Vancouver. It joins with Fifth Plain Creek at the Vancouver city limits and then turns southeast to flow through the city of Camas. Lacamas Creek joins the Washougal River in Camas, just upstream from the Columbia River. Within Camas, most of Lacamas Creek is impounded within two lakes, Lacamas Lake and Round Lake. The two lakes are connected by a short segment of stream channel that crosses under SR 500 (SE Everett Road).

There are significant areas of associated wetlands along Lacamas Creek. An estimated 1,050 acres of the Lacamas Creek shoreline planning area are mapped as wetland (Appendix A, Map 6). Wetlands in the shoreline planning area include: palustrine forested and palustrine emergent wetlands in reaches LACA_CR_01 and 02; a large wetland complex associated with both Lacamas and Fifth Plain Creeks encompassing forest and agricultural areas in reach LACA_CR_03; and extensive forested wetlands along the upper portion of the stream (reach LACA_CR_04).

6.7.1.2 Processes and Channel Modifications

Primary process and channel modifications in the Lacamas Creek basin include:

- Diversions from Lacamas Lake contribute to low flows in the lower reaches of Lacamas Creek (HDR and EES, 2006);
- Dam around Round Lake;
- Land conversion from pervious to impervious surfaces; and
- Replacement of forests with agricultural and residential use.

Lacamas Creek has been extensively modified by human activities. The Georgia-Pacific Camas Mill has a large water right for Lacamas Lake, Columbia River, and nearby groundwater. The diversions from the lake have significantly reduced flows in the lower reach of Lacamas Creek. Additionally, the dam around Round Lake has altered the natural hydrology of Lacamas Creek and limited fish passage (Wade, 2001). There are no flow limitations on the operation of the dam.

6.7.1.3 Geologic and Flood Hazard Areas

The underlying geology for much of Lacamas Creek is alluvial fan deposits and alluvium (Appendix A, Map 8). Geologists suspect that Lacamas Creek used to flow into Burnt Bridge Creek prior to the Missoula Floods, which deposited alluvial materials and diverted this stream into Lacamas Lake and the Washougal River. Peat deposits are also noted to the west in what could have been the original stream channel. The Lacamas Lake fault line runs parallel to Lacamas Creek and Lacamas Lake (USGS, 2006). According to U.S. Geological Survey (USGS) maps, this fault line is estimated to be approximately 13 miles long and was documented in a recent study on earthquake hazards in the I-5 corridor (Barnett et al., 2009).

Flood hazards occur along Lacamas Creek, primarily upstream of Lacamas Lake, associated with streamflow. Flooding is identified in FEMA (2007) FIRMs and shown in Appendix A, Map 6. The floodplain upstream of Lacamas Lake and downstream of Fifth Plain Creeks varies from approximately 0.2 mile to one mile wide. Lacamas Creek is classified as having a moderate-low to moderate-high potential for channel migration (Olson, 2010; Appendix A, Map 27). Severe erosion hazards have been identified in the lower reach of Lacamas Creek (Appendix A, Map 12). The upper Lacamas Creek watershed consists of unconsolidated sediment and seismic hazards (Appendix A, Map 13). The lower reach includes landslide hazards due to areas of potential instability (Appendix A, Map 14).

6.7.1.4 Critical or Priority Habitat and Species Use

Lacamas Creek provides habitat for federally-listed Chinook salmon, coho salmon, chum salmon, and steelhead from the confluence with the Washougal River up to the dam at Lacamas Lake (RM 0.9) (WDFW, 2009a; WDFW, 2009b). This lowest reach of the stream is designated as critical habitat for Chinook, chum, and steelhead (70 FR 52630). Several priority oak woodlands are mapped along Lacamas Creek (WDFW, 2009a). Priority wood duck habitat is also mapped along the middle segment of Lacamas Creek (WDFW, 2009a).

The WDNR Natural Heritage Program maps seven priority plant species and three priority habitats at 421 locations within the shoreline planning area of Lacamas Creek (WDNR, 2008) (Table 6-12).

Table 6-12. Priority Plants and Habitats

| Species or Habitat | Federal Status | State Status |
|---|-----------------------|---------------------------|
| Bradshaw's lomatium | Endangered | Endangered |
| Dense sedge | None | Threatened |
| Hairy-stemmed checker-mallow | None | Endangered |
| Hall's aster | None | Threatened |
| Nuttall's quillwort | None | Sensitive |
| Oregon Coyote-thistle | None | Threatened |
| Oregon White Oak - (Oregon Ash) / Common Snowberry | None | Sensitive |
| Small-flowered Trillium | None | Sensitive |
| Tufted Hairgrass - California Oatgrass | None | No status yet assigned |
| Western Wahoo | None | Threatened |

6.7.1.5 Instream and Riparian Habitats

The lower reach of Lacamas Creek (RM 0 to RM 0.9 – the dam on Lacamas Lake) is rated high for large wood recruitment potential based on the presence of dense, mature riparian forest (R2 Resource Consultants, 2004). However, the majority of Lacamas Creek and the Washougal River basin within Clark County has poor quality riparian habitat (R2 Resource Consultants, 2004c). Lower Lacamas Creek functions as off-channel habitat for the Washougal River mainstem, providing refugia for salmon and steelhead (R2 Resource Consultants, 2004c). Riparian habitat in the upper Lacamas Creek basin is considered impaired (R2 Resource Consultants, 2004c).

6.7.1.6 Water Quality

Lacamas Creek is on Ecology's 303(d) impaired list as a Category 5 polluted water for dissolved oxygen, fecal coliform, pH, and temperature (Ecology, 2008). Lacamas Creek is also listed as a Category 2 water of concern for pH. Also, see Lacamas Lake water quality impairments (Section 6.10.1.6).

6.7.2 Shoreline Use Patterns

6.7.2.1 Existing Land and Shoreline Uses

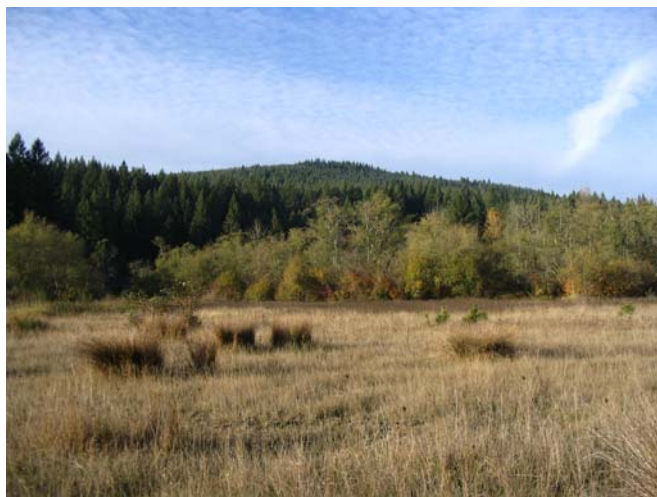
Lacamas Creek flows southwest from the east side of the county through timber lands, rural, pasture and agricultural lands, and more developed areas near the city of Camas and its UGA. The existing use pattern in the upper reaches of the basin is predominantly forestry, agriculture and former military reservation lands.

Upper Lacamas Creek (reach LACA_CR_04) is located in the former Camp Bonneville Military Reservation (Photo 6-1). Camp Bonneville comprises approximately 3,840 acres. The U.S.

Army used Camp Bonneville for live fire of small arms, assault weapons, and artillery between 1910 and 1995.

In 1995, Camp Bonneville was selected to be closed and transferred to Clark County for public benefit. The Army transferred ownership of the property to the County in 2006, which subsequently transferred the land to the Bonneville Conservation Restoration and Renewal Team LLC (BCRRT). The BCRRT will hold the deed of the property during clean-up activities until the remediation is completed (<http://www.bcrtr.org/index.asp?page=home>).

Photo 6-1. View of Camp Bonneville Firing Range, Upper Lacamas Creek (October 2007)



The lower reaches of the stream flow through a significant wetland complex that is largely undeveloped with the exception of agricultural uses. More intensively developed areas in the lower reaches of the shoreline planning area include higher density single-family neighborhoods and portions of the Camas Meadows Golf Course. Several roads parallel and cross the stream. There are road crossings at NE 3rd Avenue, NE Goodwin Road, NE 4th Plain Road, and NE 217th Avenue as well as several private road crossings in the upper reaches. There are no data on shoreline modifications.

6.7.2.2 Shoreline Environment Designations and Zoning

Lacamas Creek begins in the unincorporated area of Clark County and winds through the cities of Camas and Vancouver, as well as their UGAs, before joining the Washougal River. The downstream portion of this stream has the environment designation of Conservancy on the east shore and most of the west shore where the intent is for less development and some recreational use, and Urban on a portion of the west shore where the planning area intersects higher-intensity development in the city of Camas. The upstream portions of Lacamas Creek all have a shoreline environment designation of Rural, which is intended to allow for intensive agriculture and recreation.

In the upstream areas, most of the properties bordering Lacamas Creek are zoned for agriculture with some forestry and residential uses. The downstream areas are zoned for parks and open space, primarily on the eastern shore, and commercial, industrial, and residential on the western shore. A summary of the zoning designations along Lacamas Creek is shown in Table 6-13.

Table 6-13. Lacamas Creek Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Agriculture | 1,393 | 55% |
| Forest | 317 | 13% |
| Commercial | 11 | < 1% |
| Industrial | 139 | 6% |
| Moratorium* | 17 | < 1% |
| Parks & Open Space | 93 | 4% |
| Residential – Multi-Family | 19 | < 1% |
| Residential – Single-Family | 527 | 21% |
| Total | 2,516 | 100% |

*See section 6.10.2.2 for explanation of moratorium

6.7.2.3 Existing Public Access

There are many public access and recreational opportunities within the Lacamas Creek shoreline planning area, including several regional parks and the public Camas Meadows Golf Club. Also included are the Lacamas Heritage Trail and Lacamas Park trail networks, which include over three miles of fully developed mixed-use trails and over seven miles of planned trails. See also the description of public access for Lacamas Lake, below.

Over 300 acres of the former Camp Bonneville military installation that have been converted to public land lie within the Lacamas Creek shoreline planning area. After the cleanup and removal of hazardous wastes and unexploded ordnance is complete, Camp Bonneville will be developed for timber harvest and recreational uses. Planned recreational facilities include the Camp Bonneville Trail, a regional park with camping areas, and conservation areas for wildlife (<http://www.clark.wa.gov/campbonneville/index.html>)

A summary of the public access facilities in the Lacamas Creek shoreline planning area is shown in Table 6-14.

Table 6-14. Lacamas Creek Public Access Facilities

| Facility Name | Facility Type | Area or Length within Shoreline | Status |
|-------------------------|----------------------------------|---------------------------------|--------------------------------|
| Lacamas Lake Park | Regional Park | 29.4 acres / 23.2 acres | Developed/ Improved Greenspace |
| Camas Meadows Golf Club | Golf Course | 85.4 acres | Developed |
| Camp Currie | Special Facility | 64.0 acres | Partially Developed |
| Lacamas Heritage Trail | Trail Corridor/ Shared-use Trail | 15.8 acres 1.2 miles | Improved Greenspace/ Developed |
| Former Camp Bonneville | Regional Mixed Recreation | 317 acres | Proposed |
| Camp Bonneville Trail | Trail | 0.8 miles | Proposed |
| Unnamed Trail | Trail | 0.9 miles | Developed |
| Unnamed Trail | Trail | 6.6 miles | Proposed |

6.7.2.4 Historical and Cultural Resources

Cultural resources within the Lacamas Creek shoreline planning area include several recorded pre-contact materials and campsites, some of which date to 6,000 to 9,000 years before present. Native American use of the entire Clark County area, including areas around Lacamas Creek, is documented in detail in the Columbia River shoreline section. There are 18 total recorded materials within the Lacamas Creek shoreline planning area, 14 of which are pre-contact sites, including camp sites, lithic material scatters and isolates. The remaining four recorded sites include unregistered historic structures and sites, including a historic religious property, a historic homestead, a refuse scatter dump and an unspecified structure. The majority of recorded sites are within areas of more significant recent development, in the city of Camas.

There are no documented historic properties within the Lacamas Creek shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.7.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base there are no listed facilities or contaminated sites within the Lacamas Creek shoreline planning area.

However, in the upper Lacamas Creek area, Camp Bonneville contains contaminants such as unexploded ordnance, explosive compounds, lead, petroleum, pesticides and volatile organic

compounds in the soil, and other chemicals in the groundwater (see Ecology website at: http://www.ecy.wa.gov/programs/tcp/sites/camp_bonneville/camp_bonneville_hp.htm) which are currently undergoing remediation.

6.7.3 Opportunity Areas

6.7.3.1 Restoration and Protection

Restoration opportunities identified in the WRIA 28 Salmon and Steelhead Limiting Factors report (Wade, 2001) include protecting and enhancing wetland habitat in the Lacamas Creek watershed. There is an opportunity to enhance floodplain and side-channel habitat within public parks along lower Lacamas Creek.

The WRIA 28 report also identifies low flows in Lacamas Creek as an impact to salmonid habitat. The report recommends addressing water withdrawals and the operation of the Round Lake dam for improved habitat management.

Restoration opportunities for the Lacamas Creek basin include the following:

- Maintain adequate summer flows to control high temperature;
- Educate landowners regarding best management practices for various land uses;
- Develop and enhance thermal refugia for rearing salmon; and
- Protect and enhance wetlands throughout the watershed.

6.7.3.2 Public Access

The existing and planned recreational facilities provide many opportunities for public access to Lacamas Creek, both locally and regionally.

6.7.4 Reach Scale Assessment

Lacamas Creek has been divided into four reaches. Table 6-15 provides a brief description of each reach and highlights key modifications, unique features and restoration opportunities.

Table 6-15. Reach Assessment for Lacamas Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|---|----------------------|--|--|---|
| LACA_CR_01 | From confluence with the Washougal River to the confluence with Round Lake. | 1.5 | Suburban with minimal development in close proximity. Large park area. | Dam on Lacamas Lake. | Majority of reach is within the Lacamas Lake Park. | High quality within the park with dense vegetation. Moderate quality outside of park. Banks vegetated with shrubs but floodplain partly developed. | Enhance floodplain and side channel habitat. Protect floodplain areas. |
| LACA_CR_02 | From confluence with Lacamas Lake to confluence with Fifth Plain Creek. | 5.9 | Rural. Agriculture and park lands Conversion of forests to agricultural and residential use. | | Lower portion passes through the Camas Meadows Golf Club on west and Camp Currie Park on the east. Large expanse of associated wetlands (418 acres) and floodplains. | Varies. Generally moderate quality. Lower portion in parks is well vegetated with shrubs and trees but has some development within floodplain. Upper portion is vegetated with shrubs along bank only and then changes to grasslands and agricultural areas in an open floodplain. | Riparian restoration and improvement. |

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|--|--|---|--|---|
| LACA_CR_03 | From confluence with Fifth Plain Creek to confluence with Matney Creek. | 3.3 | Rural. Agriculture and natural areas. Minimal development. | Conversion of forests to agricultural and residential use. | One road crossing with bridge. Large area of associated wetlands (320 acres). | Moderate to high quality. Stream bank vegetated with shrubs and trees, lands adjacent to bank generally agriculture. Some development within floodplain. | |
| LACA_CR_04 | From confluence with Matney Creek to confluence with North Fork Lacamas Creek. | 4.3 | Natural areas. Minimal development. | Remediation required for former Camp Bonneville. | Majority of reach is in former military owned public lands. Approximately 296 acres of wetland. | High quality. Stream bank vegetated with shrubs and trees. Minimal development within floodplain. | Remediate contaminated soils and restore riparian vegetation in affected areas. |

6.8 Round Lake

6.8.1 Physical and Biological Characterization

6.8.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Round Lake is located southeast of Lacamas Lake within the 67-square-mile Lacamas Creek drainage basin. Round Lake is connected to Lacamas Lake by a narrow channel that flows under SE Everett Road. This lake is 0.4 miles long and 0.2 miles wide at its maximum width (USGS, 1993a). Round Lake and its neighboring waterbody, Lacamas Lake, are impoundments of Lacamas Creek. Water levels in the lakes are controlled by dams on Round Lake and Lacamas Lake. Water is diverted through a spillway and a dam into Mill Ditch for operations at the Georgia-Pacific Camas Mill.

Four acres of the Round Lake shoreline planning area are mapped as wetland by Clark County. Most of the shoreline surrounding the lake is forested, although development is present west and north of the lake.

6.8.1.2 Processes and Channel Modifications

Round Lake has been extensively modified by humans. Some of the process modifications include:

- Dams that have artificially raised water levels;
- Land conversion from pervious to impervious surfaces; and
- Dam connected to Lacamas Lake and Round Lake that has altered the natural hydrology and limits fish passage (Wade, 2001).

6.8.1.3 Geologic and Flood Hazard Areas

Flood hazards around Round Lake extend into residential areas to the northeast and southwest. Flooding associated with streamflow in Lacamas Lake and rainfall extends from Lacamas Lake to Round Lake. The flood zones are identified in FEMA (2007) FIRMs and shown in Appendix A, Map 6. Severe erosion hazards exist east of Round Lake (Appendix A, Map 12). The area within and to the west of the lake includes semi-consolidated sediment. Unconsolidated sediment exists to the north of the lake, indicating potential seismic hazard (Appendix A, Map 13). Landslide hazards are located along the entire eastern bank of the lake and are characterized by areas of potential instability and slopes greater than 15 percent (Appendix A, Map 14). Additional landslide hazards are located along the southwest bank of the lake.

6.8.1.4 Critical or Priority Habitat and Species Use

Round Lake is inaccessible to anadromous fish due to the dam constructed at the southern end of Lacamas Lake (WDFW, 2009a). No critical habitat for federally listed fish is designated along Round Lake (70 FR 52630). Priority urban natural open space is mapped for a majority of Round Lake (WDFW, 2009a). Bald eagles are known to use habitats in and around Round Lake (Appendix A, Map 11).

The WDNR Natural Heritage Program identifies priority Oregon yampah and Oregon White oak / Pacific Poison-oak / Blue wildrye habitat within the Round Lake shoreline planning area (WDNR, 2008).

6.8.1.5 Instream and Riparian Habitats

The riparian habitat along Round Lake consists of relatively dense forest wider than 200 feet in several locations (Clark County, 2007b). Only a minimal amount of intrusion into the riparian zone has occurred due to residential or road development.

6.8.1.6 Water Quality

Round Lake is a Category 5 on Ecology's 303(d) list of impaired waters due to dissolved oxygen and pH (Ecology, 2008). The lake is also considered a Category 2 water of concern for temperature exceedances. Similar to Lacamas Lake, Round Lake is classified as "eutrophic" because of high nutrient levels and biological productivity (Clark County, 2007a).

6.8.2 Shoreline Use Patterns

6.8.2.1 Existing Land and Shoreline Uses

Round Lake is located at the southern end of Lacamas Lake, separated by NE Everett Street. Existing uses in the Round Lake shoreline planning area are predominantly undeveloped parkland. The Lacamas Lake County Park nearly surrounds the entire lake. There is a mobile home park near the southwest corner of the lake and single-family residential development north of the lake.

Two roads, NE Everett Street and NE 35th Street, are located within the shoreline planning area. The Round Lake shoreline appears to be relatively unmodified. There are no piers or docks on the lake.

6.8.2.2 Shoreline Environment Designations and Zoning

Round Lake is located in the city of Camas and the Camas UGA. This shoreline planning area has an environment designation of Conservancy, intended for sparse development and passive recreational uses. This area is mostly zoned for single-family residential uses and, to a lesser extent, parks and open space. A summary of the generalized zoning designations within the Round Lake shoreline planning area is shown in Table 6-16.

Table 6-16. Round Lake Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Forest | 2 | 6% |
| Parks & Open Space | 13 | 31% |
| Residential – Multi-Family | < 1 | < 1% |
| Residential – Single-Family | 26 | 63% |
| Total | 41 | 100% |

6.8.2.3 Existing Public Access

Lacamas Park is a 312-acre county park that surrounds Round Lake. This park offers an extensive system of trails, scenic areas, picnic spots and access to the lake. Non-motorized boating and fishing are allowed on Round Lake. A summary of the public access facilities in the Round Lake shoreline planning area is shown in Table 6-17.

Table 6-17. Round Lake Public Access Facilities

| Facility Name | Facility Type | Area within Shoreline | Status |
|----------------------|----------------------|------------------------------|---------------|
| Lacamas Park | Regional Park | 22.7 acres | Developed |
| Unnamed Trails | Local Loop Trail | 1.2 miles | Developed |

6.8.2.4 Historical and Cultural Resources

There are currently no recorded archeological or unregistered historic sites in the Round Lake shoreline planning area (DAHP, 2010). Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no documented historic properties within the Round Lake shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.8.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base there are no listed facilities or contaminated sites within the Round Lake shoreline planning area.

6.8.3 Opportunity Areas

6.8.3.1 Restoration and Protection

Similar to Lacamas Lake, restoration opportunities for Round Lake include educating property owners to reduce their impacts on lake water quality.

Water withdrawals and the existing operational plan for the dam on Round Lake significantly reduce flows into Lacamas Creek during the summer months (Wade, 2001). A major restoration opportunity lies in water withdrawal management.

6.8.3.2 Public Access

The majority of the Round Lake shoreline planning area is currently used for recreation, providing good opportunities for public access.

6.8.4 Reach Scale Assessment

Round Lake has been evaluated as one shoreline reach. Table 6-18 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-18. Reach Assessment for Round Lake

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|--|----------------------------|---|---|--|
| ROUN_LK_01 | East of Lacamas Creek and east of Fallen Leaf Lake | 2.0 | Park land with some residential development. | Presence of dam structure. | Lacamas Creek flows in and out of lake. Surrounded by Lacamas Lake Park. Approximately 4 acres are wetland. | High quality. Shoreline is fully vegetated with shrubs and trees. | Public education. Preservation of intact riparian zones. |

6.9 Fallen Leaf Lake

6.9.1 Physical and Biological Characterization

6.9.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Fallen Leaf Lake (formerly called Dead Lake) is located south of Lacamas Lake and west of Round Lake in the city of Camas. The lake is bordered by steep forested slopes to the west and south, wetlands to the east, and Lacamas Lake Road to the north. This lake is 0.35 miles long and 0.1 miles wide at its maximum width (USGS, 1993a). In 1918, water from Fallen Leaf Lake was piped into the city of Camas for use in fighting fires (City of Camas, 2010c). A more sophisticated system was adopted after fire destroyed part of downtown in 1923 (City of Camas, 2010c). No water withdrawals are currently known for the lake.

Fallen Leaf Lake drains to the east to Lacamas Lake through a small outlet stream and series of wetlands.

Fallen Leaf Lake is located in a forested area, west of Round Lake and south of Lacamas Lake. An estimated 17 acres of the Fallen Leaf Lake shoreline planning area are mapped as wetland by Clark County. The National Wetlands Inventory maps palustrine emergent and palustrine scrub-shrub wetlands along the lakeshore.

6.9.1.2 Processes and Channel Modifications

Fallen Leaf Lake is surrounded by a wooded area on the west, south, and east that extends 0.1 mile from the edge of the lake. The north shore of the lake is adjacent to residential development and roads. The primary modification around Fallen Leaf Lake is the conversion of forests to residential structures and roads.

6.9.1.3 Geologic and Flood Hazard Areas

The 100-year flood zone around Fallen Leaf Lake is connected to the southeast section of the floodplain around Lacamas Lake. Flooding in Fallen Leaf Lake is associated with water levels in Lacamas Lake. The floodplain is identified on the FEMA (2007) FIRMs (Appendix A, Map 6). Severe erosion hazards exist to the west of Fallen Leaf Lake (Appendix A, Map 12). The area within and to the north, south, and west of the lake includes semi-consolidated sediment. Unconsolidated sediment exists to the east of the lake, between Lacamas Lake and Fallen Leaf Lake, and is associated with seismic hazards (Appendix A, Map 13). Landslide hazards are located along the entire western bank of the lake and are characterized by areas of potential instability and slopes greater than 15 percent (Appendix A, Map 14).

6.9.1.4 Critical or Priority Habitat and Species Use

Fallen Leaf Lake is inaccessible to anadromous fish (WDFW, 2009a) and no critical habitat for federally listed fish is designated for this lake (70 FR 52630). Priority urban natural open space is mapped for Fallen Leaf Lake (WDFW, 2009a). Similar to Round Lake, bald eagle territories are documented in and around this area (Appendix A, Map 11).

The WDNR Natural Heritage Program identifies Douglas fir / beaked hazel / swordfern habitat within the Fallen Leaf Lake shoreline planning area (WDNR, 2008).

6.9.1.5 Instream and Riparian Habitats

The riparian habitat along Fallen Leaf Lake consists of wetlands and relatively dense forest. Only a minimal amount of intrusion into the riparian zone has occurred at the north end from road development (Clark County, 2007b).

6.9.1.6 Water Quality

Fallen Leaf Lake is not recorded on Ecology's 303(d) list of impaired waterbodies (Ecology, 2008). However, this does not necessarily mean that there are no water quality problems; it may be an indication that the lake has not been assessed for quality concerns.

6.9.2 Shoreline Use Patterns

6.9.2.1 Existing Land and Shoreline Uses

The Fallen Leaf Lake shoreline planning area includes developed trails, a privately owned (Georgia Pacific) park with developed picnic shelter, restrooms, volleyball court, lake access, forested areas as well as a caretaker mobile home. This lake is held in private ownership by the Georgia-Pacific Camas Mill which is responsible for environmental stewardship. A 43-acre forested parcel to the west of the lake was purchased by the Columbia Land Trust and held for the benefit of the City of Camas. Once a cemetery was located near this lake, which at the time was known as Dead Lake Cemetery, but the cemetery has since been moved, along with its name.

6.9.2.2 Shoreline Environment Designations and Zoning

Fallen Leaf Lake lies entirely within the zoning jurisdiction of the City of Camas. The majority of this shoreline planning area is zoned for single-family residential, with a small portion of multi-family residential. A summary of the generalized zoning designations surrounding Fallen Leaf Lake is shown in Table 6-19. This lake was recently included in the updated Camas Shoreline Master Program (SMP) and has Natural and Conservancy shoreline environment designations.

Table 6-19. Fallen Leaf Lake Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|-----------|-------------|
| Residential – Multi-Family | 2 | 3% |
| Residential – Single-Family | 51 | 97% |
| Total | 53 | 100% |

6.9.2.3 Existing Public Access

The land surrounding Fallen Leaf Lake is wholly inside the Camas city limits. This site is continuous to a larger park and open space system including Fallen Leaf Lake Park to the south, Heritage Park and the Heritage Trail to the north, and the Lacamas Lake Regional Park to the east.

6.9.2.4 Historical and Cultural Resources

Fallen Leaf Lake was formerly the home of Dead Lake Cemetery, a Catholic cemetery. In 1984, the graves were moved from the cemetery to the Camas Cemetery. There are currently no recorded archeological or unregistered historic sites in this shoreline planning area (DAHP, 2010). Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no documented historic properties within the Fallen Leaf Lake shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.9.2.5 Areas of Special Interest

There are no Ecology-listed facilities or contaminated sites within the Fallen Leaf Lake shoreline planning area.

6.9.3 Opportunity Areas

6.9.3.1 Restoration and Protection

Restoration opportunities in the Fallen Leaf Lake shoreline planning area include removing invasive vegetation and reestablishing native riparian plantings, particularly in areas impacted by informal recreational access on the eastern side of the lake. The Columbia Land Trust owns forested property along the western side of Fallen Leaf Lake.

6.9.3.2 Public Access

The City of Camas Parks Plan identifies strategies for providing limited public access to the lake consistent with maintaining limited developed activities within this area. The City of Camas Parks and Open Space Plan identifies a desire to acquire property along the eastern side of the lake to create a public park around the existing privately owned picnic and recreation area and to formalize or develop trails that connect to other City of Camas trail systems.

6.9.4 Reach Scale Assessment

Fallen Leaf Lake has been evaluated as one shoreline reach. Table 6-20 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-20. Reach Assessment for Fallen Leaf Lake

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|--|---|------------------------------------|---|--|
| FALL_LK_01 | West of Lacamas Creek and west of Round Lake | 1.2 | Natural area, owned by Georgia-Pacific Mill and Land Trust | Uphill development, former cemetery. Sediment transport from urban runoff. | Approximately 17 acres of wetland. | High quality. Shoreline is fully vegetated with shrubs and trees. | Remove invasive species. Protect water quality by controlling runoff and sediment from upstream developments. Protect intact riparian areas. |

6.10 Lacamas Lake

6.10.1 Physical and Biological Characterization

6.10.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Lacamas Lake is part of the 67-square-mile Lacamas Creek watershed and is situated north of the city of Camas between SR 500 and NE Goodwin Road (Clark County, 2004d). The lake is 2.4 miles long, less than a quarter of a mile wide at its widest point, and approximately 60 feet deep at its deepest point (Clark County, 2004d). Round Lake is connected to Lacamas Lake via a small channel that flows under SE Everett Road. Lacamas Lake is a natural lake but water levels were raised by approximately 12 feet after the construction of a dam at the southern end of the lake in 1883 (Clark County, 2004d). The dam was constructed for industrial water supply and to float logs down the lake during the timber boom of the late 19th and early 20th centuries.

The Georgia-Pacific Camas Mill in Camas draws water from Lacamas Lake for its operations (Clark County Public Works Clean Water Program, undated).

Existing uses in the watershed are forest, agriculture, residential, commercial, and industrial. The eastern shoreline of Lacamas Lake is rural, forested and agricultural, while the western shoreline contains a golf course and residential development.

An estimated 148 acres of wetland are mapped in the Lacamas Lake shoreline planning area. A large wetland complex consisting of palustrine aquatic bed, emergent, and forested habitats is located on the southeastern side of the lake. A few other smaller wetlands are present at the north end of the lake.

6.10.1.2 Processes and Channel Modifications

Lacamas Lake has been extensively modified by humans. Some of the process modifications include:

- Dams that have artificially raised water levels;
- Land conversion from pervious to impervious surfaces; and
- Diversions from Lacamas Lake that contribute to low flows in the lower reaches of Lacamas Creek (HDR and EES, 2006).

Water levels in Lacamas Lake have been artificially raised by the installation of dams. The first dam was built in 1883 at the southern end of the lake and raised water levels in the lake by 12 feet (Clark County, 2010). The deeper water facilitated movement of floating logs to a lumber mill on Lacamas Creek. An additional dam and aqueduct were built to convey water from Round Lake to the Georgia-Pacific Camas Mill.

The Georgia-Pacific Camas Mill has a large water right for Lacamas Lake, Columbia River, and groundwater (HDR and EES, 2006). The diversions from the lake have significantly reduced flows in the lower reach of Lacamas Creek. Additionally, the dam around Round Lake has altered the natural hydrology of Lacamas Creek. There are no flow limitations on the operation of the dam.

6.10.1.3 Geologic and Flood Hazard Areas

The underlying geology for much of Lacamas Lake is alluvial fan and lake deposits (Appendix A, Map 8). Lake deposits are unconsolidated black mud, silt and organics that have formed in the Lacamas Lake valley (USGS, 2006). The Lacamas Lake fault line runs toward the southeast in line with Lacamas Lake (USGS, 2006).

Flood hazards occur in Lacamas Lake and upstream of the lake, associated with streamflow and operation of the dams. Flooding associated with streamflow upstream of the lake and precipitation in Lacamas Lake and surrounding area is identified in FEMA (2007) FIRMs and shown in Appendix A, Map 6. The floodplain upstream of Lacamas Lake and downstream of Fifth Plain Creek varies from approximately 0.2 mile to one mile wide. Severe erosion hazards are located along the western edge of the lake (Appendix A, Map 12). Lacamas Lake consists of and is primarily surrounded by semi-consolidated sediment. The wetland areas north of Lacamas Lake and to the southeast consist of unconsolidated sediment and are associated with seismic hazards (Appendix A, Map 13). Areas adjacent to the western and northeast banks of Lacamas Lake consist of areas associated with landslide hazards with slopes greater than 15 percent (Appendix A, Map 14).

6.10.1.4 Critical or Priority Habitat and Species Use

The dam at the southern end of the lake is a barrier to anadromous fish. Lacamas Lake historically supported cutthroat trout, but this species is considered extirpated from the lake due to changes in water quality over the years (Clark County, 2004d). No priority fish species or habitat are now documented. Urban natural open space is mapped along the southwestern portion of the lake (WDFW, 2009). The lake also provides habitat for state sensitive bald eagles (Appendix A, Map 11; WDFW, 2009).

The WDNR Natural Heritage Program identifies Federal Candidate and State Sensitive Species tall bugbane within the Lacamas Lake shoreline planning area (WDNR, 2008).

6.10.1.5 Instream and Riparian Habitats

Lacamas Lake experiences excessive aquatic plant growth due to relatively high nutrient levels (Clark County, 2007). Clarity is low in the summer because of algal growth and an aquatic weed, Brazilian elodea, which forms dense mats in shallow water. Suitable water temperatures for fish in the lake during the summer are found at depths greater than four to six feet, but a depletion of dissolved oxygen reduces the suitability of these cold-water areas. Suitable fish habitat is consequently restricted to a narrow stratum, if present at all (Clark County, 2007a). Because of these water quality limitations, the lake is not able to sustain native cutthroat trout populations. Non-native bass, perch, and bluegill appear to be self-sustaining but these populations were found to be in poor condition due to slow growth and low recruitment in a 1997 study (Clark County, 2007a). Dissolved oxygen depletion is indicated as the main stressor that inhibits normal fish population growth (Clark County, 2007a).

Riparian habitat varies around the lake. On the west side of the lake, the riparian zone ranges from 50 to 200 feet wide with some intrusion from residential development at the northwest end of the lake (Clark County, 2007b). Road development on the east side of the lake limits riparian

vegetation to a primarily tree-less band less than 20 feet wide, while a large patch of forest is located along the southern end of the lake.

6.10.1.6 Water Quality

Lacamas Lake is on Ecology's 303(d) list of impaired waters due to exceedances for total phosphorous, PCB, dissolved oxygen, fecal coliform, pH, and temperature (Ecology, 2008). The lake is currently listed as a Category 5 polluted water for PCB and phosphorus. Tissue from brown trout and largemouth bass sampled in 2003 did not exceed National Toxic Rule criteria for several toxic chemicals including mercury and toxaphene, to name a few (Ecology, 2008). Lacamas Lake is also listed for an invasive aquatic species, Brazilian elodea (Ecology, 2008).

Water quality problems persist in Lacamas Lake, despite government-funded efforts between 1987 and 2001 to address high nutrient levels and raise public concern about the lake's water quality (Clark County, 2007a). Persistent water quality issues include severe dissolved oxygen depletion, poor water clarity, high levels of algal growth, nuisance blue-green algae blooms, and dense beds of Brazilian elodea (Clark County, 2007a).

Eutrophication was first observed in the lake in 1970, which led to the development of a Phase I Diagnostic and Restoration Study (Giglio and Erickson, 1996). Eutrophication is a natural process but can be accelerated by land use activities that result in large amounts of nutrients entering aquatic systems. The goal of this basin-wide plan was to reduce phosphorous loading in the water by implementing best management agricultural practices at the surrounding dairy farms (Giglio and Erickson, 1996). The EPA in-lake criterion for total phosphorus to avoid eutrophication is 0.025 milligrams per liter (mg/L). In 2004, the mean total phosphorus remained near 0.050 mg/L and above the recommended limit. Although this represents a considerable decrease in phosphorus when compared to 1984 (0.089 mg/l), the lake remains eutrophic (Clark County, 2004d).

While phosphorous levels in the lake have decreased, nutrient levels including nitrogen inputs remain a water quality concern (Clark County, 2004d). An increasing trend in nitrogen has been documented along with high levels of algal production. Clark County continues to monitor water quality in the lake to inform management decisions (Clark County, 2007a). Since 2007, lake water quality monitoring has been conducted in cooperation with the Clark County volunteer monitoring program.

6.10.2 Shoreline Use Patterns

6.10.2.1 Existing Land and Shoreline Uses

Lacamas Lake is located at the terminus of Lacamas Creek. The lake is wholly within the Camas UGA portion of Clark County; however, the lake's shoreline planning area is within the City of Camas boundary. The west shore of the lake is predominantly single-family residential with some open/recreational space. Homes are generally separated from the lake by a vegetated hillside, resulting in a relatively unmodified shoreline. The Heritage Trail also travels the length of the west shoreline between the homes and the lake.

The east shore of the lake is characterized primarily by undeveloped lands with a few existing residences including the historic Leadbetter House. There are also some residential and

commercial developments at the southern end of the lake including a restaurant. SE Leadbetter Road runs most of the length of the east side of the lake. The lake shore has riprap supporting the roadway along much of the eastern shore.

There are several docks on the lake, many of which are located on the western shore. Two of the docks on the west shore are associated with a boat launch owned by the Lacamas Shores Homeowners Association and a set of community docks located within the Heritage Park and associated boat launch owned and maintained by the City of Camas. The existing Moose Lodge building and dock are also owned by the City of Camas and within this area. A privately owned dock is also located within the Lacamas Shores development. A third boat launch is located on the east side of the lake and appears to be accessible to the public from Leadbetter Road.

6.10.2.2 Shoreline Environment Designations and Zoning

Lacamas Lake lies within the city of Camas and Clark County. The shoreline environment designation is Conservancy, which is intended for passive agriculture and recreational uses. Most of the western shore of Lacamas Lake is zoned as single-family residential, with the northern end and parts of the eastern shore zoned for parks and open space. The remainder of the eastern shore reflects zoning designated as “moratorium” in the data set used for this report (see Section 2.3.1); however, the City of Camas has since lifted those restrictions upon completion of its capital facilities plan. This area now reflects zoning intended for industrial and small amounts of commercial and residential. A summary of the generalized zoning designations surrounding Lacamas Lake is provided in Table 6-21.

Table 6-21. Lacamas Lake Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Commercial | 1 | < 1% |
| Moratorium | 28 | 18% |
| Parks & Open Space | 57 | 36% |
| Residential – Multi-Family | 7 | 5% |
| Residential – Single-Family | 671 | 42% |
| Total | 161 | 100% |

6.10.2.3 Existing Public Access

Lacamas Lake provides many recreational access points for shoreline and water use. There are boat launches, picnic facilities, mixed-use trails, and beaches. Camp Currie, a youth camp, is located on the northern shore of the lake. A summary of the public access facilities is shown in Table 6-22.

Table 6-22. Lacamas Lake Public Access Facilities

| Facility Name | Facility Type | Area or Length within Shoreline | Status |
|-------------------------|---------------------------------|---------------------------------|---------------------|
| Camas Meadows Golf Club | Golf Course | 0.7 acres | Developed |
| Camp Currie | Special Facility | 64.0 acres | Partially Developed |
| Heritage Park | Undefined Park | 17.1 acres | Developed |
| Lacamas Heritage Trail | Open space/ Shared-use Trail | 18.4 acres/ 2.1 miles | Developed |
| Lacamas Park | Regional Park | 0.1 acre | Developed |
| Unnamed Trail | Trail | 475 feet | Developed |

6.10.2.4 Historical and Cultural Resources

Cultural resources within the Lacamas Lake shoreline planning area include several recorded pre-contact materials and campsites. Native American use of the entire Clark County area, including areas around Lacamas Lake, is documented in detail in the Columbia River shoreline section. There are eight recorded materials within the lake's shoreline planning area, all of which are pre-contact sites, including camp sites, lithic material scatters and isolates. The large majority of recorded sites are within city of Camas jurisdiction.

Historic resources are documented through a variety of sources. Official registers include the National Register of Historic Places and the Washington State Heritage Register. The Washington Information System for Architectural and Archaeological Records Data was used to identify state and federal historic resources within the Lacamas Lake shoreline planning area, as well as other shoreline areas in Clark County.

There is one registered historic property, the Pittock-Leadbetter House. Listed on both the state and federal registers in 1978, the house was built in 1902 (Photo 6-2) (National Register of Historic Places Registration Form – Pittock-Leadbetter House, 1978).

Photo 6-2. Pittock-Leadbetter House (undated). Accessed Jan 2010 from DAHP.



6.10.2.5 Areas of Special Interest

The Lacamas Lake shoreline planning area includes eight Ecology-listed sites, which are located within the city of Camas (Reach LACA_LK_01). Seven of the eight sites are Tier 2 Emergency/Hazard Chemical Reports submitted for City of Camas facilities. In addition, a Leaking Underground Storage Tank facility cleanup occurred in 1996 within the reach.

6.10.3 Opportunity Areas

6.10.3.1 Restoration and Protection

Lacamas Lake is nutrient-rich and experiences algal blooms and low dissolved oxygen levels. Between 1987 and 2001, the Lacamas Lake Restoration Program undertook major efforts to improve water quality in the lake by reducing nutrient inputs from agricultural areas (Clark County Public Works Clean Water Program, undated). While these efforts have significantly reduced lake nutrient levels, development activities in the watershed continue to impact water quality (Clark County Water Resources, 2007). Opportunities remain to work with landowners to reduce their water quality impacts on the lake.

Restoration opportunities for Lacamas Lake include the following (Clark County, 2007a; Wade, 2001):

- Maintain public interest in improving water quality conditions in the lake;
- Address water withdrawal policies;
- Address summer depleted oxygen issues, possibly by mechanically introducing oxygen to the lake; and

- Control Brazilian elodea growth.

6.10.3.2 Public Access

The existing and planned recreational facilities provide many opportunities for public access to Lacamas Lake, both locally and regionally.

6.10.4 Reach Scale Assessment

Lacamas Lake has been evaluated as one shoreline reach. Table 6-23 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-23. Reach Assessment for Lacamas Lake

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|---|--|--|--|--|
| LACA_LK_01 | Lake formed by dam, lies between Lacamas Creek Reaches 1 and 2 | 7.1 | Suburban. Residential areas and park areas. | Dam structure present. Flow diversions. Water quality impairments due to runoff. Roadway parallels the eastern lakeshore and has associated riprap. Three boat launches. Docks on the western shore. | Lacamas Creek flows through lake. West shore is part of Heritage Trail Park. Approximately 148 acres of wetland. | Varies. East shore has high quality vegetation with shrubs and trees along bank and little development within floodplain. West shore has moderate quality vegetation with shrubs and trees along bank and residential development within floodplain. | Reduce nutrient input. Use BMPs to reduce non-point pollution from agricultural uses. Enhance and restore associated wetlands. Protect floodplain wetlands. Protect forested riparian areas. |

6.11 Fifth Plain Creek

6.11.1 Physical and Biological Characterization

6.11.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Fifth Plain Creek is a tributary of Lacamas Creek that drains 4.6 square miles of rural residential land in Clark County (Clark County, 2004c). This stream is located in the northeast corner of the city of Vancouver. Fifth Plain Creek flows southeasterly over moderately steep terrain and enters Lacamas Creek at RM 10. The primary tributary of Fifth Plain Creek is Shanghai Creek. Fifth Plain Creek is also fed by a large wetland partly within and immediately to the north of Vancouver's UGA. The upper portion of the watershed is forested and agricultural, while the lower portion in the Vancouver UGA is urbanized.

Approximately 860 acres of the Fifth Plain Creek shoreline planning area is mapped as wetland. This large wetland system (consisting of emergent, shrub and forested wetland habitats) encompasses several drainage sub-basins and includes rural, forested and agricultural areas (Appendix A, Map 6).

6.11.1.2 Processes and Channel Modifications

Primary process and channel modifications in the Fifth Plain Creek basin include:

- Conversion of forests to agricultural and rural residential uses; and
- Conversion of pervious to impervious surfaces.

Fifth Plain Creek flows through an area where most of the forest has been converted to pasture and impervious surfaces. The increase in impervious surfaces results in increased runoff in Fifth Plain Creek and increased rate of channel incision.

6.11.1.3 Geologic and Flood Hazard Areas

The geologic formations in the Fifth Plain Creek drainage are alluvium and alluvial fan deposits (Appendix A, Map 8). Flood hazards along Fifth Plain Creek are primarily associated with streamflow. The floodplain adjacent to Fifth Plain Creek is identified in the FEMA (2007) FIRMs and shown in Appendix A, Map 6. No erosion hazards have been identified in the Fifth Plain Creek sub-basin (Appendix A, Map 12). Fifth Plain Creek consists of unconsolidated sediment and is adjacent to semi-consolidated sediments (Appendix A, Map 13) indicating potential seismic hazard along Fifth Plain Creek. No landslide hazards have been identified (Appendix A, Map 14).

6.11.1.4 Critical or Priority Habitat and Species Use

No federally listed anadromous fish species can access Fifth Plain Creek due to downstream passage barriers (WDFW, 2009). Priority oak woodlands are mapped along Fifth Plain Creek near the confluence with Lacamas Creek (WDFW, 2009).

The WDNR Natural Heritage Program identifies State Threatened dense sedge within the Fifth Plain Creek shoreline planning area (WDNR, 2008).

6.11.1.5 Instream and Riparian Habitats

The channel substrate of Fifth Plain Creek consists primarily of coarse gravel with some cobbles (Clark County, 2004c). Volunteers observed some fine material embedded in streambed gravels during water quality testing and field surveys. This observation indicates erosion from upstream sources (Clark County, 2004c). Deciduous trees dominate the riparian zone and provide an estimated cover of 80 to 90 percent in the summer (Clark County, 2004c). Reed canarygrass and Himalayan blackberry (invasive species) are abundant along Fifth Plain Creek (Clark County, 2004c).

6.11.1.6 Water Quality

Fifth Plain Creek is listed as Category 5 on Ecology's 303(d) impaired list for dissolved oxygen and temperature (Ecology, 2008). This stream is also listed as a Category 2 water of concern for pH and fecal coliform. Average water quality index scores for a suite of parameters (total phosphorous, fecal coliform, nitrate, temperature, pH, and dissolved oxygen) for Fifth Plain Creek ranged from "fair" to "excellent" (Clark County, 2004c). Most water quality problems occurred in the summer during low flows and are related to poor water quality from tributaries (i.e., China Ditch). The stream scored excellent for temperature, dissolved oxygen and pH during the winter months (Clark County, 2004c) (see Appendix A, Map 15).

6.11.2 Shoreline Use Patterns

6.11.2.1 Existing Land and Shoreline Uses

Fifth Plain Creek flows approximately two miles through unincorporated Clark County and the city of Vancouver's UGA, with a small portion of the stream's planning area within the city of Vancouver. The stream flows through primarily rural and agricultural lands to its confluence with Lacamas Creek. Existing uses are characterized by low-density rural residential development and pasture/agricultural uses. A large wetland complex to the east is also associated with Fifth Plain Creek. Higher density single-family residential development is located to the west within Vancouver's UGA.

The shoreline planning area begins immediately south of NE Ward Road and crosses NE 88th Street and NE Fourth Plain Road as it flows south before joining Lacamas Creek. There are no water-oriented uses with the shoreline planning area.

No levees or other significant shoreline modifications are mapped along the stream. The portion of Fifth Plain Creek from Ward Road to Fourth Plain Road is relatively straight with a regular stream width, indicating that the stream was likely ditched and/or straightened in the past.

6.11.2.2 Shoreline Environment Designations and Zoning

The Fifth Plain Creek shoreline planning area has a current environment designation of Rural. This designation is intended for the heavy agriculture uses historically found in this area. Fifth Plain Creek is surrounded by mostly agricultural zoning in the upstream areas, and by single-family residential zoning within and near the city of Vancouver. A summary of the zoning designations along Fifth Plain Creek is shown in Table 6-24.

Table 6-24. Fifth Plain Creek Zoning

| Zoning Designation | Acreage | Percentage |
|-----------------------------|----------------|-------------------|
| Agriculture | 414 | 44% |
| Forest | 8 | < 1% |
| Commercial | 6 | < 1% |
| Industrial | 6 | < 1% |
| Residential – Single-Family | 500 | 54% |
| Total | 934 | 100% |

6.11.2.3 Existing Public Access

There is one planned trail that will traverse approximately one-half mile of the Fifth Plain Creek shoreline planning area. Currently there is no public access provided.

6.11.2.4 Historical and Cultural Resources

Cultural resources within the Fifth Plain Creek shoreline planning area include two recorded pre-contact materials and camp sites. In addition, there are two unregistered historic hydroelectric facilities and one unregistered historic residential structure / refuse scatter. Native American use of the entire Clark County area, including areas around Fifth Plain Creek, is documented in detail in the Columbia River shoreline section.

There are no county-, state-, or federally-listed historic properties within the Fifth Plain Creek shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.11.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base there are no listed facilities or contaminated sites within the Fifth Plain Creek shoreline planning area.

6.11.3 Opportunity Areas

6.11.3.1 Restoration and Protection

Restoration opportunities include controlling invasive vegetation and restoring wetlands that have been impacted by grazing and agricultural activities. Public acquisition of wetland areas associated with Fifth Plain Creek would protect downstream water quality.

The City of Camas, WDNR, and Clark County are working to restore large areas in the Fifth Plain Creek watershed. The City has applied for funding from the Washington Wildlife and Recreation Coalition to acquire acreage along the stream to create a riparian mitigation bank.

Restoration and management opportunities include (Clark County, 2004c):

- Restore native riparian vegetation and control invasive species;
- Control stormwater runoff and runoff from farm fields;

- Resolve failing septic tanks; and
- Address low summer flow problems.

6.11.3.2 Public Access

The majority of the property surrounding Fifth Plain Creek is privately owned, with few opportunities for development of public access. Clark County could work cooperatively with private property owners, possibly in conjunction with trail construction, to develop access to portions of the Fifth Plain Creek shoreline planning area. For example, a spur trail could be developed from the Evergreen School District property, through the neighboring forested area, toward Fifth Plain Creek to provide wildlife viewing and educational resources. Public acquisition of wetland areas along Fifth Plain Creek should be considered for wetland restoration and conservation purposes.

6.11.4 Reach Scale Assessment

Fifth Plain Creek has been evaluated as one shoreline reach. Table 6-25 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-25. Reach Assessment for Fifth Plain Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|--|----------------------|---|--|--|---|--|
| FIPL_CR_01 | From 20cfs point to confluence with Lacamas Creek. | 2.3 | Rural and agricultural uses. Minimal development. | Conversion of forests to residential uses. Significant associated wetlands at risk due to development and agricultural uses. | One road crossing with bridge. Approximately 860 acres of wetland in broad floodplain. Significant wetland resource with restoration potential | Moderate to low quality. Bank is sporadically vegetated with shrubs. Floodplain is generally agricultural land. | Invasive species control and removal. Protect and enhance floodplain wetlands. Restore and protect floodplain. Restore significant wetland areas to protect downstream water quality. |

6.12 Matney Creek

6.12.1 Physical and Biological Characterization

6.12.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

Matney Creek is in the upper Lacamas Creek watershed and originates from the base of Livingston Mountain. It flows approximately five miles through hilly terrain until its confluence with Lacamas Creek near 68th Avenue. Only the lowest river mile is included in the study area. No major tributaries feed Matney Creek within the shoreline planning area, but Little Matney Creek joins the mainstem at approximately RM 2. The Camp Bonneville Military Reservation is within the Matney Creek basin, northeast of the mainstem. Existing uses in the Matney Creek watershed include agriculture, forest land, and large-lot residential development.

Approximately 27 acres of the Matney Creek shoreline planning area is mapped as wetland. This wetland is palustrine forested, based on review of aerial photos.

6.12.1.2 Processes and Channel Modifications

Primary process and channel modifications in the Matney Creek basin include:

- Conversion of forested lands into pastures; and
- Conversion of forested lands into rural residential developments.

Although the Matney Creek basin is outside of the existing urban area, it has experienced conversion of forested lands into agricultural lands and rural residential growth. The increased runoff of water and sediment due to the removal of trees has led to channel incision and increased transport of sediment to the stream.

6.12.1.3 Geologic and Flood Hazard Areas

Flood hazards along Matney Creek are primarily associated with streamflow, as identified in FEMA (2007) FIRMs and shown in Appendix A, Map 6. Matney Creek is classified as having a moderate potential for channel migration (Olson, 2010; Appendix A, Map 27). No severe erosion hazards have been identified adjacent to Matney Creek (Appendix A, Map 12). The Matney Creek basin consists of semi-consolidated sediment and is associated with seismic hazards (Appendix A, Map 13). There are no landslide hazards identified adjacent to Matney Creek (Appendix A, Map 14).

6.12.1.4 Critical or Priority Habitat and Species Use

No federally listed anadromous fish species can access Matney Creek due to the dam at the downstream end of Lacamas Lake (WDFW, 2009a; WDFW, 2009b). Resident cutthroat are the only priority species mapped for this stream (WDFW, 2009a). There are bald eagle territories in the vicinity of Matney Creek (Appendix A, Map 11).

The WDNR Natural Heritage Program does not identify priority plant species or vegetation communities within the Matney Creek shoreline planning area (WDNR, 2008).

6.12.1.5 Instream and Riparian Habitats

In a 2001 habitat and water quality study conducted at four sampling sites along this stream, general aquatic habitat was rated marginal to sub-optimal using the EPA Rapid Assessment Protocol (Schnabel, 2002). The sampling site near 68th Avenue within the study area scored 105 out of 200, which is considered “sub-optimal” for the following habitat parameters: epifaunal substrate (rocks and large wood), pool substrate, pool variability, sediment deposition, channel flow status, degree of channel alteration, bank stability, bank vegetation cover, and riparian habitat width. For comparison, a relatively high quality reach of Jones Creek in the Washougal River basin scored 163, which is in the optimal range.

6.12.1.6 Water Quality

Matney Creek is on Ecology’s 303(d) list of impaired waters (Category 5) for dissolved oxygen, fecal coliform, and temperature (Ecology, 2008). Matney Creek scored low to high on the Benthic Index of Biological Integrity following a 2001 water quality study that assessed conditions at four sites along the stream (Schnabel, 2002). Optimal conditions for benthic macroinvertebrates (aquatic insects) were observed in the upper mainstem (outside of the study area), while moderate conditions (34 points out of 50) were observed near 68th Avenue within the shoreline planning area (Schnabel, 2002). For comparison, a reference site in Jones Creek scored 46 out of 50 on the biological integrity index. The Jones Creek site is on land owned by the City of Camas, is off-limits to the public and relatively undisturbed, and has a high forest cover in the surrounding area.

This study also demonstrated a negative correlation between road density and benthic invertebrate habitat: The higher the road density in the watershed, the lower the habitat quality for benthic invertebrates (Schnabel, 2002). Higher road density typically means a higher volume and frequency of stormwater runoff entering stream systems. Road density in the Matney Creek watershed is seven to nine miles of road per square mile, whereas the Jones Creek reference site has only two miles of roadway per square mile (Schnabel, 2002).

6.12.2 Shoreline Use Patterns

6.12.2.1 Existing Land and Shoreline Uses

Matney Creek is located north of the city of Camas. Its headwaters begin in the Cascade foothills and join Lacamas Creek just below Camp Bonneville. The jurisdictional extent of the stream flows approximately 1.5 miles. Existing uses in the Matney Creek shoreline planning area are characterized as rural and include forest, large-lot residential, small farms, and rural suburban in the lower areas. The stream is crossed by two rural roads: NE 68th Street and 232nd Street. There are no water-oriented uses on the stream.

6.12.2.2 Shoreline Environment Designations and Zoning

Matney Creek lies entirely within the jurisdiction of Clark County. All 88 acres bordering Matney Creek have a shoreline environment designation of Rural, intended for areas of intense agriculture. This entire area is zoned for single-family residential uses.

6.12.2.3 Existing Public Access

A 706-foot section of the proposed Camp Bonneville Trail crosses the Matney Creek shoreline planning area. There are no existing public access points at Matney Creek.

6.12.2.4 Historical and Cultural Resources

Cultural resources identified include one recorded pre-contact lithic material site. Due to the location of the stream and the documented use of the Clark County area by Chinookan-speaking peoples, there is some probability of unknown archaeological resources occurring within the shoreline planning area. Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no listed historic properties within the Matney Creek shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.12.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base, there are no facilities or contaminated sites within the Matney Creek shoreline planning area.

6.12.3 Opportunities

6.12.3.1 Restoration and Protection

Restoration opportunities identified in the WRIA 28 Salmon and Steelhead Limiting Factors report (Wade, 2001) include protecting and enhancing wetland habitat in the greater Lacamas Creek watershed.

Restoration opportunities for the Lacamas Creek basin, which includes the Matney Creek sub-basin, are as follows:

- Maintain adequate summer flows to control high temperature;
- Educate landowners regarding best management practices for various land uses; and
- Protect and enhance wetlands throughout the watershed.

6.12.3.2 Public Access

The planned trail segment will provide an opportunity for public access to the Matney Creek shoreline planning area.

6.12.4 Reach Scale Assessment

Matney Creek has been evaluated as one shoreline reach. Table 6-26 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-26. Reach Assessment for Matney Creek

| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|---|---|--|---|---|
| MATN_CR_01 | From 20 cfs point to the confluence with Lacamas Creek. | 1.4 | Rural residential and natural areas. Agriculture. | Conversion of forests to residential uses and pastures. | Two road crossings. Approximately 27 acres of wetland. | Moderate quality. Banks generally vegetated with shrubs and trees. Floodplains are agricultural land with a few developments. | Protect and enhance wetlands. Maintain summer base flows. |

6.13 North Fork Lacamas Creek

6.13.1 Physical and Biological Characterization

6.13.1.1 Drainage Basin, Tributary Streams and Associated Wetlands

The North Fork Lacamas Creek is a headwater stream and tributary of Lacamas Creek that drains forest resource lands. The North Fork Lacamas Creek flows for approximately two miles before joining the mainstem upstream of the confluence with Matney Creek (USGS, 1988).

Approximately six acres of the North Fork Lacamas Creek shoreline planning area are mapped as wetland.

6.13.1.2 Processes and Channel Modifications

The North Fork Lacamas Creek watershed is located within a forested area where there have been minimal process and channel modifications.

6.13.1.3 Geologic and Flood Hazard Areas

Flooding and flood hazards are identified in FEMA (2007) FIRMs and shown in Appendix A, Map 6. Severe erosion hazards have been identified in the upper reach of the North Fork Lacamas Creek (Appendix A, Map 12). In the lower reach, severe erosion hazard areas are located east of the stream. The North Fork Lacamas Creek consists of unconsolidated sediment and is adjacent to semi-consolidated sediment to the west and consolidated sediment to the east (Appendix A, Map 13). There is a seismic hazard in the North Fork Lacamas Creek and to the west of the stream (Appendix A, Map 13). The North Fork Lacamas Creek has landslide hazards associated with slopes greater than 15 percent and areas of older landslide debris (Appendix A, Map 14).

6.13.1.4 Critical or Priority Habitat and Species Use

No federally listed anadromous fish species can access North Fork Lacamas Creek due to the dam at the downstream end of Lacamas Lake (WDFW, 2009).

The WDNR Natural Heritage Program identifies hairy-stemmed checker-mallow within the North Fork Lacamas Creek shoreline planning area (WDNR, 2008).

6.13.1.5 Instream and Riparian Habitats

No instream or riparian habitat data are available for the North Fork Lacamas Creek. Aerial imagery of the basin indicates that the riparian habitat consists of coniferous forest (Clark County GIS, 2005).

Summer baseflows in North Fork Lacamas Creek were affected by a municipal well, but now the City of Camas has relocated its well to the lower Washougal River to an area that has minimal impact on streamflow (Giglio et al., 1996).

6.13.1.6 Water Quality

No segments of the North Fork Lacamas Creek are listed as impaired (Ecology, 2008). However, this does not necessarily mean that there are no water quality problems; it may be an indication that the stream has not been assessed for water quality.

6.13.2 Shoreline Use Patterns

6.13.2.1 Existing Land and Shoreline Uses

The North Fork Lacamas Creek is a short stream (~ 0.6 mile) that flows into the mainstem within the former Camp Bonneville Military Reservation. Existing uses in the stream's shoreline planning area consist primarily of undeveloped forest land. There are no paved roads in the shoreline planning area and no modifications are mapped.

Military operations at Camp Bonneville ceased in 1995. The 4,000-acre facility is currently owned by the Bonneville Conservation Restoration and Renewal Team (BCRRT), which is engaged in cleanup of the property. The BCRRT will maintain temporary ownership of the facility while it investigates contamination and conducts cleanup. Ecology will determine when the facility meets state cleanup requirements, after which point ownership will be transferred back to Clark County for use as a park and wilderness conservation area.

6.13.2.2 Shoreline Environment Designations and Zoning

North Fork Lacamas Creek is bordered entirely by 31.81 acres of property zoned as forest in unincorporated Clark County. This stream was not included in the existing Clark County SMP, and does not have a current shoreline environment designation.

6.13.2.3 Existing Public Access

There are no formal public access opportunities within this shoreline planning area. North Fork Lacamas Creek lies within the former Camp Bonneville property, now owned by the BCRRT. The southern end of the North Fork Lacamas Creek shoreline planning area lies within the area proposed for recreational and educational uses, which would include an outdoor school, logging camp, and amphitheater, among other facilities.

6.13.2.4 Historical and Cultural Resources

There are no recorded archeological or unregistered historic sites within the North Fork Lacamas Creek shoreline planning area (DAHP, 2010). However, due to the location of the stream and the documented use of the Clark County area by Chinookan-speaking peoples, there is some probability of unknown archaeological resources occurring within the stream's shoreline planning area. Clark County archaeological resource probability mapping suggests there is a significant chance of finding unknown artifacts within almost all of the County's shoreline planning areas (Clark County, 2003).

There are no documented historic properties within the North Fork Lacamas Creek shoreline planning area (DAHP, 2010; Clark County, 2010d).

6.13.2.5 Areas of Special Interest

According to the Ecology facilities/sites data base, no listed facilities or contaminated sites are documented within the North Fork Lacamas Creek shoreline planning area (Ecology, 2010).

6.13.3 Opportunity Areas

6.13.3.1 Restoration and Protection

Restoration opportunities for North Fork Lacamas Creek include decommissioning or repairing logging roads to prevent sedimentation, replanting riparian areas with native trees, and removing failing culverts.

Other restoration opportunities include the following:

- Educate landowners regarding best management practices for various land uses;
- Develop and enhance thermal refugia for rearing salmon; and
- Protect and enhance wetlands throughout the watershed.

6.13.3.2 Public Access

This shoreline planning area is proposed for reuse with forest management and recreational uses. North Fork Lacamas Creek is planned to be an integral part of those recreational facilities.

6.13.4 Reach Scale Assessment

North Fork Lacamas Creek has been evaluated as one reach. Table 6-27 provides a brief description of this reach and highlights key modifications, unique features and restoration opportunities.

Table 6-27. Reach Assessment for North Fork Lacamas Creek

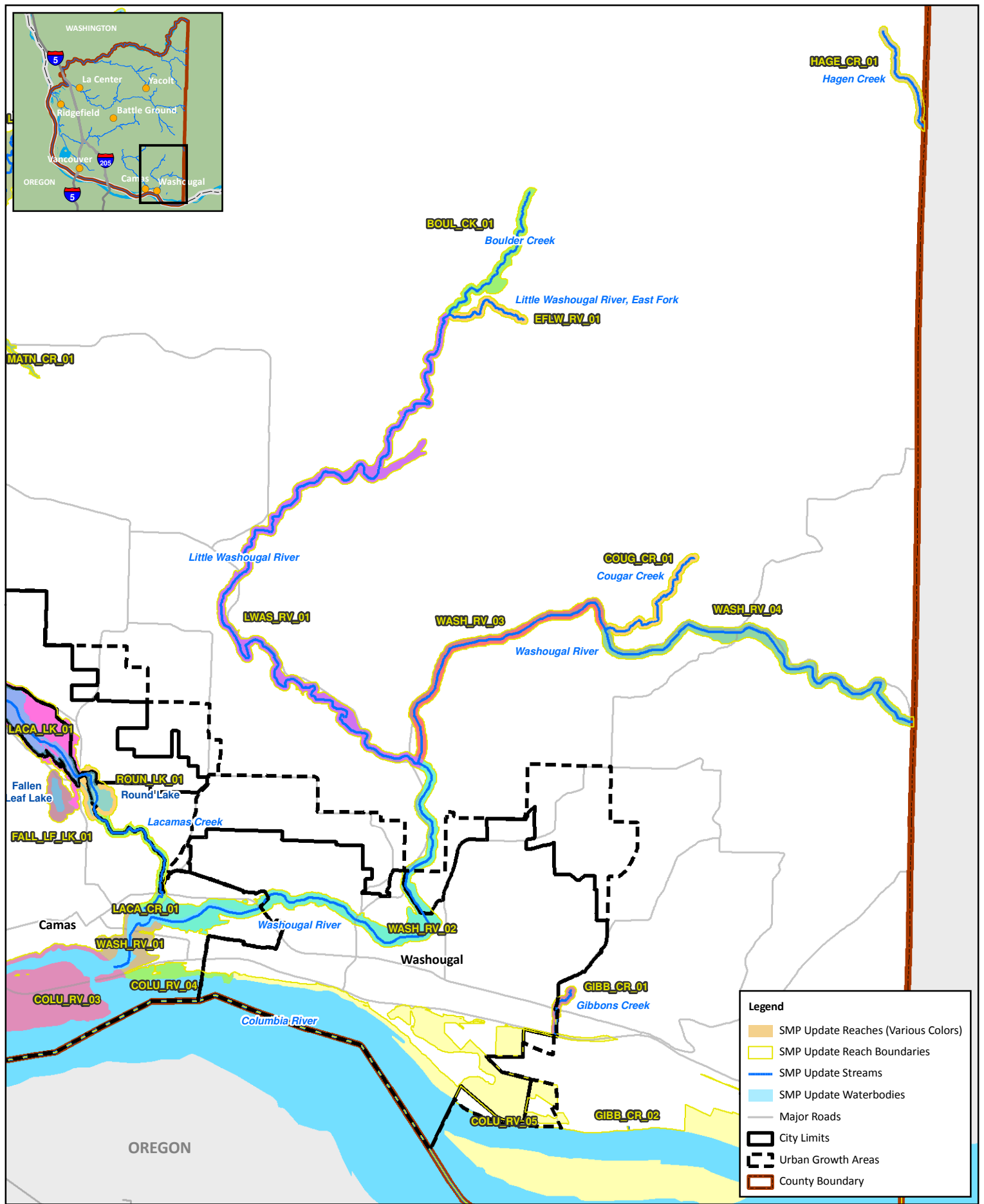
| Reach Number | Reach Location | Reach Length (miles) | Use Descriptions | Modifications | Unique Features | Riparian Zones | Restoration Opportunities |
|--------------|---|----------------------|--|---------------|--|---|--|
| NFLA_CR_01 | From 20 cfs point to confluence with Lacamas Creek. | 0.6 | Undeveloped park lands and rural uses. | None apparent | Entire reach is within former military owned public lands (Camp Bonneville). Approximately 6 acres of wetland. Steep slopes. | High quality. Banks and floodplains are well vegetated. | Replant riparian areas and remove failing culverts. Protect intact riparian areas. |

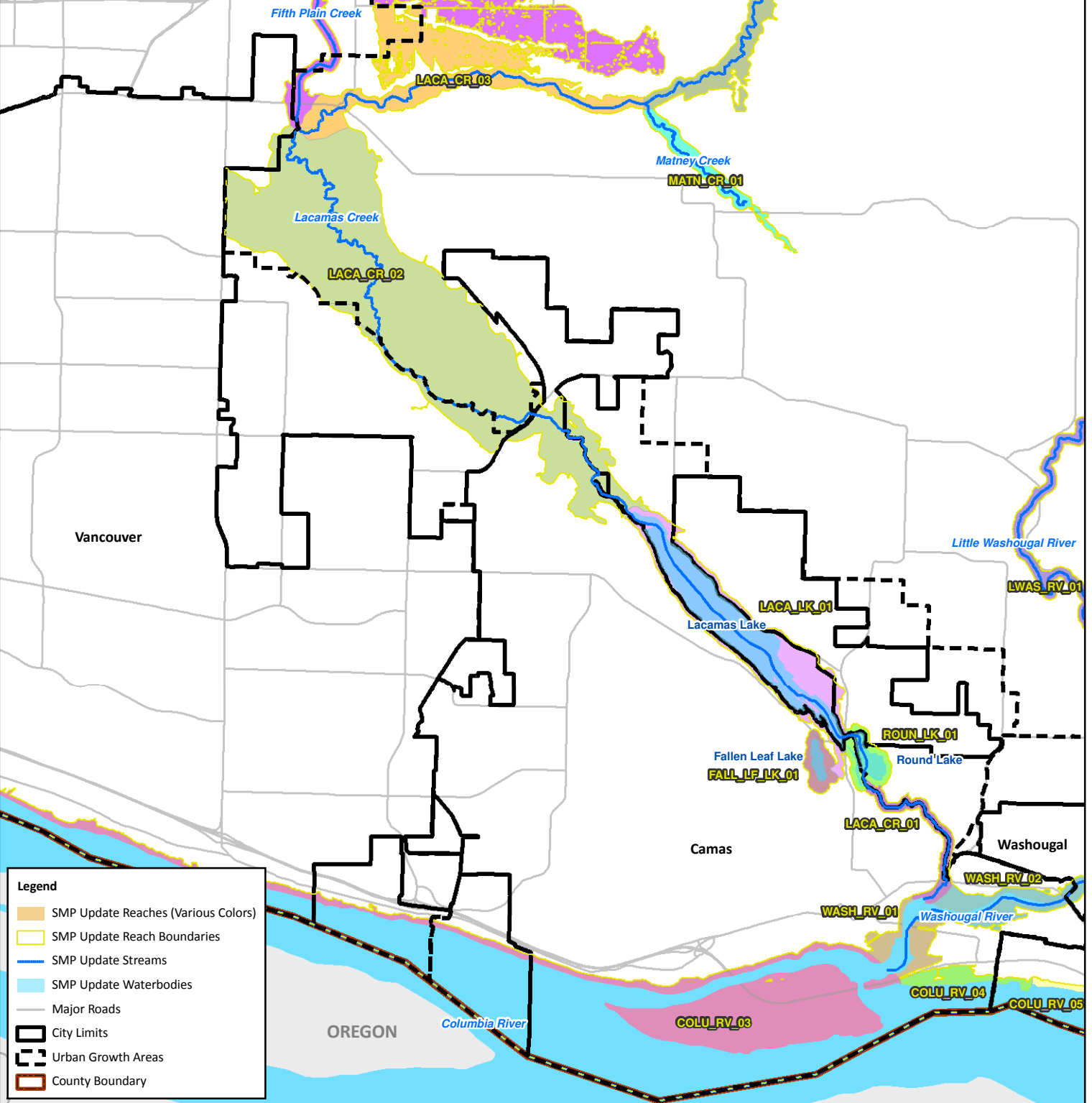
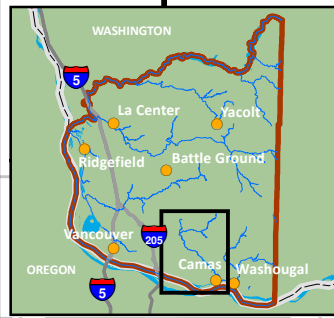
6.14 Data Gaps

The inventory and characterization report relies on GIS data, review of aerial photographs, existing technical reports, existing map products, information from the technical advisory committee, and community input. While there was a wealth of information shared, that information was not always available at a consistent level of detail for the geography under investigation. Gaps in data and information are inherent in these types of reports. The following gaps in data or information were identified during this inventory and characterization of the lower Washougal River basin:

- Current quantifiable data on shoreline modifications;
- Current data on riparian quality;
- Known or potential barriers to anadromous fish;
- Water quality parameters not assessed by Ecology as part of the Section 303(d) list;
- Water quality data and biological integrity information for Washougal River and its tributaries;
- Water quality for upper tributaries (i.e., Hagen Creek, Boulder Creek);
- Verification of the location, extent and quality of associated wetlands; and
- Up-to-date GIS park and public access layer.

Comprehensive assessment of all water withdrawals and groundwater connections to streamflow is needed to help determine what proportion of any reduction in seasonal flows is due to groundwater wells or surface water diversions.





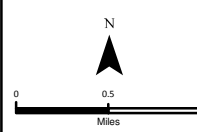
- Legend**
- SMP Update Reaches (Various Colors)
 - SMP Update Reach Boundaries
 - SMP Update Streams
 - SMP Update Waterbodies
 - Major Roads
 - City Limits
 - Urban Growth Areas
 - County Boundary

CLARK COUNTY COALITION SMP UPDATE
 BATTLE GROUND | CAMAS | CLARK COUNTY | LA CENTER
 RIDGEFIELD | VANCOUVER | WASHOUGAL | YACOLT

ESA Adolfson

SMA Grant Agreement No. G1000058
 Task 2.10
 Coordinate System: State Plane NAD1983 (ft)
 Washington South FIPS 4602

NOTE: Map data shown here are the property of the sources listed below. Inaccuracies may exist, and ESA Adolfson implies no warranties or guarantees regarding any aspect of data depiction.



Map 6 - 2
 Washougal River Basin

SOURCE: Clark County, 2009; DNR, 2007; WDOT, 2004.